AKADÉMIAI KIADÓ

Journal of Behavioral Addictions

10 (2021) 3, 747–758

DOI:
10.1556/2006.2021.00042

FULL-LENGTH REPORT

Dispositional and online-specific Fear of Missing Out are associated with the development of IUD symptoms in different internet applications

DANIELA RÖTTINGER[1]*, GALLUS BISCHOF[1], DOMINIQUE BRANDT[1], ANJA BISCHOF[1], SVENJA ORLOWSKI[1], BETTINA BESSER[1], ELISA WEGMANN[2], MATTHIAS BRAND[2] and HANS-JÜRGEN RUMPF[1]

[1] Department of Psychiatry and Psychotherapy, University of Lübeck, Lübeck, Germany

[2] Department of General Psychology, Cognition and Center for Behavioral Addiction Research (CeBAR), University of Duisburg-Essen, Germany

Received: September 5, 2020 • Revised manuscript received: January 8, 2021; May 6, 2021 • Accepted: June 13, 2021
Published online: September 15, 2021

ABSTRACT

Background and aims: An increasing number of people experience negative consequences from the excessive use of different Internet applications or sites (e.g., Instagram, League of Legends, YouTube). These consequences have been referred to as specific Internet Use Disorders (IUDs). The present study aims to examine the Fear of Missing Out (FoMO) on rewarding experiences with respect to specific Internet activities. FoMO has been found to mediate the link between psychopathology and symptoms of Internet Communication Disorder (ICD). However, the role of FoMO in other IUDs is controversial. *Methods:* The current study (N = 7,990) consecutively screened in vocational schools) analyzed the associations between online-specific state-FoMO, general trait-FoMO, mental health, and IUD symptoms in a structural equation model. After testing the model for the entire sample of Internet users, it was analyzed separately for the two main user groups: Social Networking Site (SNS) users and gamers. *Results:* The proposed model explained 42.0% of the variance in IUD symptoms in the total sample, 46.8% for SNS users, and 32.8% for gamers. Results suggest that impaired mental health and high trait-FoMO predict IUD symptoms. For both SNS users and gamers, trait-FoMO mediated the link between low mental health and IUD, whereas state-FoMO mediated the link between trait-FoMO and IUD in both user groups. *Discussion:* Our results partly support the theoretical model of specific IUDs, highlighting trait-FoMO as a predisposing fear of disconnection related to general mental health. Online-specific FoMO appears to contribute to problematic Internet use mainly because of its link to the general fear of disconnection. Moreover, the described mechanism seems to be comparable for both females and males. *Conclusions:* FoMO is a multidimensional construct underlying IUD symptoms related to the use of socially gratifying, but distinct Internet applications. FoMO and psychopathology should be targeted together in prevention and treatment plans of IUDs.

KEYWORDS

internet use disorder, I-PACE model, Fear of Missing Out, FoMO, social networking sites, gaming, structural equation modeling

*Corresponding author. Tel.: +49 15152233071; fax: +49 451 500 98754.
E-mail: daniela.roettinger@gmail.com

INTRODUCTION

Based on the worldwide Internet usage having grown by 1,239% between 2000 and 2020 (Internet World Stats, 2020), a growing number of studies have been examining addictive qualities of excessive Internet use (Kuss, Griffiths, Karila, & Billieux, 2014; Shaw & Black, 2008). Evidence of clinically significant harm from Internet gaming is extensive (Kuss & Griffiths, 2012; Pavot & Diener, 1993) but research has been pointing to negative

consequences of various online activities including gaming, communication, watching pornography, or shopping (Kuss et al., 2014).

Specifically, problems related to pathological Internet communication have increased due to the high accessibility of smartphones combined with the variety of applications for Internet communication and Social Networking Sites (SNSs) such as Facebook, WhatsApp, Twitter, and Instagram (Kuss & Griffiths, 2011, 2017). The phenomenon of experiencing symptoms such as diminished control and negative consequences in offline life due to the use of Internet communication and social media applications can be referred to as *Internet Communication Disorder* (*ICD*; Wegmann & Brand, 2016). However, research on risk mechanisms for specific *Internet Use Disorders (IUDs)* is still scarce. IUD has been described as an addictive use of the Internet, i.e. diminished control over the Internet use leading to negative consequences in daily life, which can be specified for certain genres of applications or sites (Brand, Young, Laier, Wölfling, & Potenza, 2016). The Diagnostic and Statistical Manual, Fifth Edition (DSM-5), proposed *Internet Gaming Disorder (IGD)* as a "condition for further study" (American Psychiatric Association, 2013). Furthermore, *Gaming Disorder* was introduced in the 11th revision of the International Classification of Diseases (ICD-11) as a behavioral addiction (World Health Organization, 2018). Besides *Gaming Disorder,* evidence for further behavioral addictions relate to pornography use, buying and shopping, and use of social networks (Brand et al., 2020).

Aiming to provide a theoretical framework for mechanisms underlying the development and maintenance of specific IUDs, Brand et al. (2016, 2019) developed the *I*nteraction of *P*erson-*A*ffect-*C*ognition-*E*xecution (I-PACE) model. It assumes that the effect of predisposing individual characteristics on IUD symptoms is moderated and mediated by various components such as affective and cognitive responses as well as Internet-related cognitive biases. Several studies have provided empirical support for the I-PACE model (e.g., Tavolacci et al., 2013; Wegmann, Stodt, & Brand, 2015; Starcke & Brand, 2016). A more detailed overview of the I-PACE model and its underlying empirical studies can be found in the review from Brand et al. (2016).

Wegmann, Oberst, Stodt, and Brand (2017) used the I-PACE model as a framework to examine how Internet-specific cognitions contribute to IUDs. One of these cognitions was the relatively new concept of *Fear of Missing Out (FoMO)*. Przybylski, Murayama, DeHaan, and Gladwell (2013, p. 1841) defined FoMO as "a pervasive apprehension that others might be having rewarding experiences from which one is absent", leading to the desire to stay continually connected with what others are doing. Previous research has shown that FoMO predicted (e.g., Gil, Del Valle, Oberst, & Chamarro, 2015; Chotpitayasunondh & Douglas, 2016) and mediated ICD symptoms (e.g., Przybylski et al., 2013; Oberst, Wegmann, Stodt, Brand, & Chamarro, 2017; Alt, 2015; for a review, see; Kuss & Griffiths, 2017).

Wegmann et al. (2017) identified trait-FoMO and state-FoMO as two factors of a modified version of the original FoMO scale from Przybylski et al. (2013). Trait-FoMO has been described as a stable individual characteristic and a general fear of missing out on any social experiences, whereas state-FoMO seems to represent specific cognitions that develop during online activities, especially Internet communication, and is therefore less stable. These cognitions are considered to increase an aspect of FoMO that refers specifically to other users' online experiences (Balta, Emirtekin, Kircaburun, & Griffiths, 2020; Wegmann et al., 2017). The results of Wegmann et al. (2017) suggest that state-FoMO increases the risk of experiencing ICD symptoms and mediates the link between psychopathological symptoms and ICD. Their findings support the mediating role of Internet-related cognitions in IUDs suggested by the I-PACE model (Brand et al., 2016). Trait-FoMO, however, did not predict ICD. This result contradicts those of Przybylski et al. (2013), showing that findings on trait-FoMO are inconsistent.

Furthermore, research suggests that the association of FoMO depends on the underlying Internet application. Analyzing Internet gaming, state-FoMO had no effect on IGD and was not a mediator of the relationship between psychopathological symptoms and IGD in the study by Wegmann et al. (2017). The authors concluded that IGD is not related to communication or the need to be part of a community. However, other authors have considered online games like Massively Multiplayer Online Role Playing Games (MMPORGs) to be inherently social games, allowing gamers to communicate and interact on various channels and build relationships which may extend into real life (Cole & Griffiths, 2007; Kuss, 2013; Kuss & Griffith, 2017), suggesting that multiplayer online games provide opportunities to gratify social needs and therefore involve FoMO similar to SNS use. This notion was supported by Duman and Ozkara (2019), who found the impact of social identity on online game addiction to be mediated by gamers' FoMO. Hence, findings on the role of FoMO in online gaming are again inconsistent.

The relation of FoMO to online activities other than SNS use is still debatable. As pointed out by Wegmann et al. (2017), further research should examine the construct of FoMO in detail, such as differences between ICD and IGD with respect to FoMO as well as the difference between trait- and state-FoMO.

Aim of the present study is to contribute to a better understanding of underlying mechanisms in the development of IUDs. Previous research has shown FoMO as an important factor in ICD with traditional SNSs, such as Facebook (Przybylski et al., 2013). However, it has not been clarified whether FoMO as trait or state is also associated with using Internet applications or sites that include the gratification of social needs concerning the content of the specific activity, such as MMORPGs or entertainment sites like YouTube. Therefore, our study examines the relation of FoMO to SNS use and Internet gaming since these are two of the most common online activities (Brand et al., 2020; Kuss & Griffiths, 2011, 2012). Consistent with the I-PACE model by Brand et al. (2016), we distinguish between

predisposing and mediating variables in IUDs. Our assumptions are based on the finding that online-specific FoMO, an Internet-related cognitive bias, mediated the effect of psychopathological symptoms on ICD (Wegmann et al., 2017). Figure 1 shows the associations between variables tested in the current study. We first tested this model with the entire sample including all Internet activities, and subsequently investigated differences between SNS users and gamers. Additionally, we checked for gender effects.

METHODS

Participants and procedure

The present study is part of the research project *i*ntervening in *P*roblematic *I*nternet use *(iPIN)* funded by the German Federal Ministry of Health. In the current study, a comprehensive survey was completed by students at a minimum age of 16 years at vocational schools in Germany. Students at this age have shown to be at high risk for IUDs (Sun et al., 2012; Rumpf et al., 2014;). Participants filled out the survey on their own via mobile tablet computers during class. Answering all questions took approximately 20–30 min.

The final sample constitutes consecutive screenings of 7,990 participants with 4,124 females. The mean age of the participants was 20.56 years (SD = 4.72) and ranged from 16 to 54 years. There was no significant age difference between female and male participants ($t(7{,}988) = 0.653$, $p = 0.514$).

Frequency analyses revealed that SNS use (e.g., WhatsApp, Facebook, Instagram, or Snapchat) was the main activity for most participants (62.2% of all participants), followed by gaming (e.g., Candycrush, Farmville, Call of Duty, or League of Legends) at 13.0% and video-entertainment sites (e.g. YouTube) at 15.1%. Other activities were shopping or selling (1.4%), pornography use (1.0%), gambling (e.g., poker, betting, online casino; 0.3%), researching news (2.9%), dating (e.g., Tinder or Parship; 0.1%), downloading files (0.4%), or others (3.5%). Although participants frequently noted streaming services such as Netflix or Spotify among the category of "other" activities, they were not included as an Internet activity in our study. Since they are often used passively alongside other Internet applications, we chose to focus on applications that are only used actively. We employed SNS users and gamers as two separate subsamples. Sociodemographic characteristics of the whole sample as well as of the two activity subsamples are shown in Table 1.

The two subsamples differed significantly with respect to age ($t(6{,}011) = -3.039$, $p < 0.05$) but the effect was very small (Cohen, 1988) and therefore not included in further analyses. There was a significant difference with respect to gender ($\chi^2(1) = 970.79$, $p < 0.001$): our subsamples comprised more females (n = 3,415) than males (n = 2,598). There were significantly fewer females than males engaged in Internet gaming, while more females than males used SNSs (see Table 1). Since this result had a moderate effect size (Cohen, 1988), gender effects were considered in further analyses.

The two online activities also showed a significant association with the currently pursued qualification ($\chi^2(6) = 31.67$, $p < 0.001$) and the type of accommodation ($\chi^2(6) = 26.04$, $p < 0.001$), but the effects were very small (Cohen, 1988).

Measures

Internet activities. In order to distinguish between specific Internet activities, we asked participants about the Internet applications or sites they generally use and about their first-choice activity. Response options included SNS use, gaming, gambling, shopping and selling, entertainment (e.g. YouTube), pornography, news research, dating, downloading files, or other.

Symptoms of Internet Use Disorder. To assess IUD symptoms in our study, we administered the Compulsive Internet Use Scale (CIUS; Meerkerk, Van Den Eijnden, Vermulst, & Garretsen, 2009) transformed into German by translation and back-translation (Rumpf et al., 2014b; Guertler et al., 2014). Previous studies have verified the CIUS as a valid and

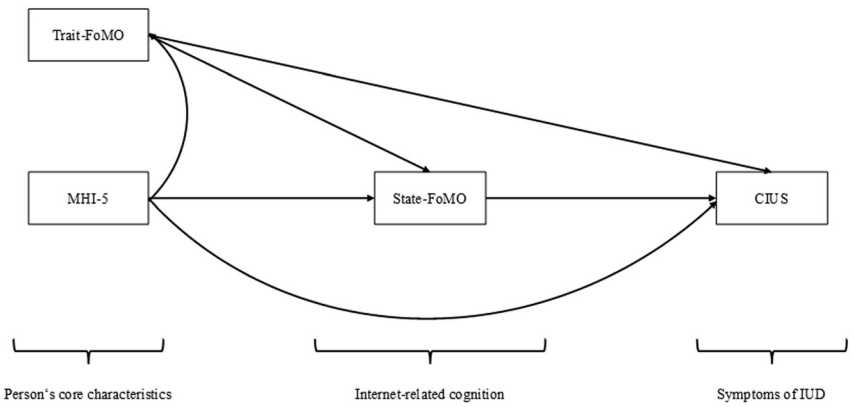

Fig. 1. The operationalized model for analyzing the suggested effects on specific IUDs

Table 1. Sociodemographic characteristics of the whole sample and its subsamples of SNS users and gamers

	Total		SNS use		Gaming		
	$N = 7{,}990^{+}$	%	$n = 4{,}973$	%	$n = 1{,}040$	%	
Age (*M*, *SD*)	20.56	4.72	20.06	4.14	20.49	4.10	$t(6{,}011) = -3.039$, $p = <0.05$, $\lvert d \rvert = 0.10$[a]
Gender							
male	3,866	48.4	1,696	34.1	902	86.7	$\chi^2(1) = 970.79$, $p < 0.001$, Cramer's V = 0.40[b]
female	4,124	51.6	3,277	65.9	138	13.3	
Pursued qualification							
Skilled occupation	5,340	66.8	3,429	69.0	634	61.0	$\chi^2(6) = 31.67$, $p < 0.001$, Cramer's V = 0.07[b]
First general degree	138	1.7	98	2.0	19	1.8	
Intermediate degree	594	7.4	368	7.4	96	9.2	
Advanced technical college	601	7.5	332	6.7	107	10.3	
School & vocational training	214	2.7	130	2.6	32	3.1	
University entrance	947	11.9	556	11.2	135	13.0	
Retraining/further training	156	2.0	60	1.2	17	1.6	
Accommodation							
Alone	800	10.0	476	9.6	102	9.8	$\chi^2(6) = 26.04$, $p < 0.001$, Cramer's V = 0.07[b]
With (grand)parents	5,557	69.5	3,532	71.0	776	74.6	
With partner	919	11.5	587	11.8	88	8.5	
With partner & child	221	2.8	114	2.3	12	1.2	
Alone with child	70	0.9	45	0.9	2	0.2	
Shared flat	399	5.0	208	4.2	59	5.7	
Assisted living	24	0.3	11	0.2	1	0.1	

Notes: [+] The sample size consists of all participants, who use SNSs, gaming, but also all other activities such as shopping or pornography.
n: valid values; *M*: mean; *SD*: standard deviation. Values in the first row show the mean age and standard deviations of the subsamples instead of group sizes and percentage values in relation to the whole sample.
[a]results from an independent *t*-test with the two subsamples. [b]results from a χ^2-test with the two subsamples.

widely used tool to assess IUDs (Downing, Antebi, & Schrimshaw, 2014; Guertler et al., 2014; Rumpf et al., 2014; Wartberg, Petersen, Kammerl, Rosenkranz, & Thomasius, 2014; Yong, Inoue, & Kawakami, 2017).

The CIUS consists of 14 items and has a value range of 0–56. Higher scores indicate more severe IUD symptoms. The items measure five core criteria of IUDs: loss of control, preoccupation, withdrawal symptoms, conflict, and coping with unpleasant mood. Questions were answered on a five-point Likert-scale from 0 (= never) to 4 (= very often). Meerkerk et al. (2009) reported a stable one-factor solution in different samples. The scale showed good reliability, with Cronbach's α ranging from 0.88 to 0.93 (Meerkerk et al., 2009; Van Rooij, Schoenmakers, Vermulst, Van Den Eijnden, & Van De Mheen, 2011; Wartberg et al., 2014), and was validated across different samples (Khazaal et al., 2012; Wartberg et al., 2014; Yong et al., 2017).

Fear of Missing Out. Based on the original ten-item FoMO scale from Przybylski et al. (2013); Wegmann et al. (2017) developed a modified version to assess general and online-specific fears of being out of touch with one's social environment. Wegmann and colleagues concluded with a bifactorial twelve-item scale including five items for trait-FoMO and seven items for state-FoMO. Participants answered on a five-point Likert-scale from 1 (= totally disagree) to 5 (= totally agree). Mean scores were calculated, with higher scores indicating higher FoMO. Wegmann et al. (2017) found that reliability of the two-factor FoMO scale was good (trait-FoMO: $\alpha = 0.82$; state-FoMO: $\alpha = 0.81$).

Mental health. We administered the Mental Health Inventory (MHI-5; Berwick et al., 1991). Its five items determine the extent of experiencing anxiety, depression, general positive affect, as well as behavioral and emotional control during the past month. We used the German version of the instrument (Bullinger, 1995; Rumpf, Meyer, Hapke, & John, 2001). Participants answered on a five-point Likert-scale ranging from 1 (= none of the time) to 5 (= all of the time). We inverted all item scores except for those measuring positive affect. The MHI-5 has a value range from 5 to 25, with higher scores reflecting better mental health (Rumpf et al., 2001). Rumpf et al. (2001) found satisfying internal consistency (Cronbach's $\alpha = 0.74$), as well as good performance for identifying mood and anxiety disorders (AUC = 0.88 and 0.71, respectively).

Statistical analyses

Statistical analyses were conducted in SPSS 26.0. for Windows (IBM SPSS statistics). We calculated Pearson correlations by testing the bivariate correlations between the variables. Multivariate analyses of variance (MANOVA) were used to test for differences between SNS users and gamers as well as regarding male and female participants. For these analyses the scores described in the measures section were used. The mediation analyses were computed with MPlus 6 (Muthén & Muthén, 2011). To reduce possible measurement errors, to stabilize parameter estimates, to better analyze non-normal distributed data, and to improve the model fit in the structural equation model (SEM), the method of item parceling was used. In the subset item parceling approach, neither the model nor the constructs measured are changed, but the items of all questionnaires were randomly split in two halves, and the mean scores from half of the variables each were calculated. These "*new*" variables could be used to build the latent dimensions of the SEM (Little, Cunningham, Shahar, & Widaman, 2002; Marsh, Lüdtke, Nagengast, Morin, & von Davier, 2013). For model fit evaluation, we used standard criteria: standardized root mean square residual (SRMR; values <0.08 indicated a good fit with the data), comparative fit indices (CFI/TLI; values >0.90 indicated an acceptable fit with the data), and root mean square error of approximation (RMSEA; values <0.08 indicated a good fit with the data) (Hu & Bentler, 1995, 1999). The χ^2 test was used to check the data derivation of the defined model. However, before analyzing the SEM, the correlations between all relevant variables were checked (Baron & Kenny, 1986).

Ethics

The study procedures were carried out in accordance with the Declaration of Helsinki. The study was approved by the ethics committee of the University of Lübeck. All subjects were informed about the study and provided informed consent. Parental consent was sought for those younger than 18 years of age.

RESULTS

Descriptive values and multivariate statistics

The mean sum scores and standard deviations of all scales for the whole sample as well as for the two different activity subsamples are shown in Table 2. Investigating differences using multivariate analyses of variance with main activity and gender as between factors, results indicate that male participants scored significantly lower in trait-FoMO and showed higher state-FoMO and MHI-5 score than female participants. We also found significant differences regarding the preference of SNS use and gaming behavior in trait-FoMO and state-FoMO scores indicating that those individuals preferring social networks experience higher trait- and state-FoMO compared to gamers, whereas gamers reported higher symptom severity. There was a significant interaction effects regarding the MHI-5 score (see Table 2).

The bivariate correlations between the CIUS sum score and trait-FoMO, state-FoMO and the MHI-5 scores are shown in Table 3, illustrating small to moderate significant effect sizes for the total sample as well as for the SNS users and gamers. In addition, all variables based on item parceling were significantly correlated as well (all r's ≤ 0.472 and ≥ 0.062).

The structural equation model

The SEM on a latent dimension – by using the variables based on item parceling – showed an excellent fit with

Table 2. Mean sum scores (standard deviations) of the variables for the total sample and the two main activity subsamples

		SNS use			Gaming			
	Total $N = 7{,}990^{+}$	Overall $n = 4{,}973$	Male $n = 1{,}696$	Female $n = 3{,}277$	Overall $n = 1{,}040$	Male $n = 902$	Female $n = 138$	Multivariate analysis of variance
CIUS	17.90 (9.28)	17.67 (9.13)	17.07 (8.98)	17.88 (9.19)	20.22 (9.21)	20.32 (9.12)	19.59 (9.79)	$F_{\text{activity}}(1,6013) = 30.54$, $p \leq 0.001$, $\eta_p^2 = 0.005$; $F_{\text{gender}}(1,6013) = 0.05$, $p = 0.830$, $\eta_p^2 \leq 0.001$; $F_{\text{intearction}}(1,6013) = 3.47$, $p = 0.063$, $\eta_p^2 = 0.001$
Trait-FoMO	2.05 (0.85)	2.13 (0.87)	1.99 (0.84)	2.20 (0.87)	1.87 (0.79)	1.83 (0.77)	2.10 (0.89)	$F_{\text{activity}}(1,6013) = 9.56$, $p = 0.002$, $\eta_p^2 = 0.002$; $F_{\text{gender}}(1,6013) = 34.27$, $p \leq 0.001$, $\eta_p^2 = 0.006$; $F_{\textit{interaction}}(1,6013) = 0.76$, $p = 0.385$, $\eta_p^2 \leq 0.001$
State-FoMO	2.25 (0.73)	2.32 (0.75)	2.35 (0.75)	2.30 (0.74)	2.20 (0.69)	2.22 (0.69)	2.20 (0.69)	$F_{\text{activity}}(1,6013) = 23.44$, $p \leq 0.001$, $\eta_p^2 = 0.004$; $F_{\text{gender}}(1,6013) = 6.08$, $p = 0.014$, $\eta_p^2 = 0.001$; $F_{\text{interaction}}(1,6013) = 1.24$, $p = 0.265$, $\eta_p^2 \leq 0.001$
MHI-5	18.25 (2.36)	18.10 (3.45)	18.82 (3.27)	17.72 (3.48)	18.92 (3.50)	19.22 (3.22)	17.00 (4.49)	$F_{\text{activity}}(1,6013) = 1.01$, $p = 0.315$, $\eta_p^2 \leq 0.001$; $F_{\text{gender}}(1,6013) = 102.37$, $p \leq 0.001$, $\eta_p^2 = 0.017$; $F_{\text{interaction}}(1,6013) = 11.58$, $p = 0.001$, $\eta_p^2 = 0.002$

$^{+}$ The sample size consists of all participants, who use SNSs, gaming, but also all other activities such as shopping or pornography.

Table 3. Bivariate correlations between the scores of the CIUS and the applied scales for the total sample and for the two main activity subsamples

	Trait-FoMO	State-FoMO	MHI-5
Total			
CIUS	0.427**	0.464**	−0.356**
Trait-FoMO		0.465**	−0.377**
State-FoMO			−0.177**
SNS use			
CIUS	0.454**	0.497**	−0.393**
Trait-FoMO		0.486**	−0.368**
State-FoMO			−0.202**
Gaming			
CIUS	0.385**	0.366**	−0.272**
Trait-FoMO		0.366**	−0.334**
State-FoMO			−0.056

*$p < 0.050$.
**$p \leq 0.010$.

the data. The RMSEA was 0.064, CFI was 0.984, TLI was 0.967, and the SRMR was 0.024. The χ^2 test was significant, ($p \leq 0.001$). For the total sample, the results show that the model proposed in Fig. 1 could explain 42.0% of the variance in CIUS scores. The results indicate that the latent dimensions were well represented by the manifest variables used. It is shown that MHI-5 as well as trait-FoMO and state-FoMO had a significant direct effect on symptom severity due to the problematic use of the Internet in general. Trait-FoMO also had a direct effect on state-FoMO, whereas the MHI-5 score only affected trait-FoMO directly. In addition, we also found significant mediation effects. The effect of trait-FoMO on CIUS was significantly mediated by state-FoMO. The effect of MHI-5 on CIUS was significantly mediated by trait-FoMO as well as by trait-FoMO and state-FoMO, but not by state-FoMO solely. The final model with CIUS as dependent variable including factor loadings, β-weights, p-values, and residual variances is shown in Fig. 2.

However, to control these mediation effects with respect to SNS use or gaming as the main online activity, we analyzed the model with preferred activity as group variable using mean structure analysis (RMSEA = 0.070, CFI = 0.975, TLI = 0.961, SRMR = 0.034, χ^2 test $p \leq 0.001$). For SNS users, the latent dimensions were well represented by the manifest variables ($\beta > 0.590$, $p < 0.001$), and the hypothesized mediation effects could explain 46.8% of the variance in the symptom severity of problematic SNS use. For gamers, again, the latent dimensions were well represented by the manifest variables ($\beta > 0.609$, $p < 0.001$) and the mediation effects explained 32.8% of the variance. The SEM results for SNS users and gamers including factor loadings, β-weights, p-values, and residual variances are shown in Table 4. The comparison of the two different models focusing on SNS use and gaming outlines that the effects of mental health and FoMO are comparable for the two different online activities even if state-FoMO mediated the effect of mental health on symptom severity only for gamers. Nevertheless, looking at the effect sizes, the results illustrate that although the effects are comparable, higher effect sizes could be observed in SNS users (see Table 4).

We additionally controlled the results for possible gender differences. Therefore again, we analyzed the model with preferred activity and gender as group variables using mean structure analyses (RMSEA = 0.068, CFI = 0.974, TLI = 0.964, SRMR = 0.035, χ^2 test $p \leq 0.001$). Overall, the manifest variables represented the latent dimension well ($\beta > 0.524$, $p \leq 0.001$). We found similar effects for male SNS users (variance of the CIUS $R^2 = 0.388$), female SNS users (variance of the CIUS $R^2 = 0.509$), male gamers (variance of the CIUS $R^2 = 0.338$) and female gamers (variance of the CIUS $R^2 = 0.364$), indicating that low

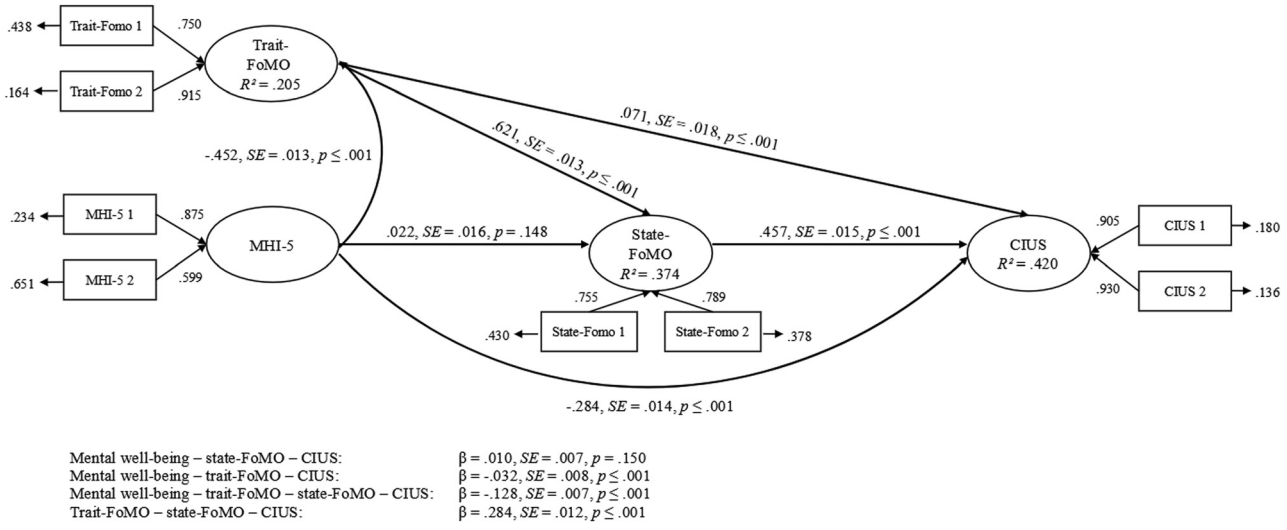

Fig. 2. Results of the SEM for the total sample with CIUS as dependent variable including factor loadings and the accompanying β-weights, p-values, and residuals

Table 4. SEM coefficients for direct and indirect effects for SNS users (4a) and gamers (4b)

a.		SNS use		
		β	*SE*	*p*
Direct	MHI-5 – Trait-FoMO	−0.450	0.016	≤0.001
	MHI-5 – State-FoMO	−0.016	0.019	0.414
	MHI-5 – CIUS	−0.310	0.017	≤0.001
	Trait-FoMO – State-FoMO	0.616	0.016	≤0.001
	Trait-FoMO – CIUS	0.089	0.021	≤0.001
	State-FoMO – CIUS	0.455	0.019	≤0.001
Indirect	MHI-5 – state-FoMO – CIUS	−0.007	0.009	0.413
	MHI-5 – trait-FoMO – CIUS	−0.040	0.009	≤0.001
	MHI-5 – trait-FoMO – state-FoMO – CIUS	−0.126	0.008	≤0.001
	Trait-FoMO – state-FoMO – CIUS	0.280	0.014	≤0.001
Trait-FoMO R^2 = 0.202, State-FoMO R^2 = 0.388, CIUS R^2 = 0.468.				
b.		Gaming		
		β	*SE*	*p*
Direct	MHI-5 – Trait-FoMO	−0.378	0.035	≤0.001
	MHI-5 – State-FoMO	0.111	0.046	0.016
	MHI-5 – CIUS	−0.259	0.038	≤0.001
	Trait-FoMO – State-FoMO	0.584	0.038	≤0.001
	Trait-FoMO – CIUS	0.107	0.048	0.027
	State-FoMO – CIUS	0.400	0.048	≤0.001
Indirect	MHI-5 – state-FoMO – CIUS	0.044	0.020	0.024
	MHI-5 – trait-FoMO – CIUS	−0.040	0.019	0.030
	MHI-5 – trait-FoMO – state-FoMO – CIUS	−0.088	0.016	≤0.001
	Trait-FoMO – state-FoMO – CIUS	0.233	0.034	≤0.001
Trait-FoMO R^2 = 0.143, State-FoMO R^2 = 0.304, CIUS R^2 = 0.328.				

mental health, higher trait-FoMO, higher state-FoMO as well as the main mediation effect of these variables significantly increase the risk of problematic SNS use and online gaming, respectively (for detailed information on the mediation effect, see Tables 5 and 6).

Table 5. SEM coefficients for direct and indirect effects for female (5a) and male (5b) SNS users

a.		Female		
		β	*SE*	*p*
Direct	MHI-5 – Trait-FoMO	−0.434	0.019	≤0.001
	MHI-5 – State-FoMO	−0.030	0.022	0.177
	MHI-5 – CIUS	−0.289	0.019	≤0.001
	Trait-FoMO – State-FoMO	0.626	0.018	≤0.001
	Trait-FoMO – CIUS	0.098	0.025	≤0.001
	State-FoMO – CIUS	0.493	0.022	≤0.001
Indirect	MHI-5 – state-FoMO – CIUS	−0.015	0.011	0.175
	MHI-5 – trait-FoMO – CIUS	−0.043	0.011	≤0.001
	MHI-5 – trait-FoMO – state-FoMO – CIUS	−0.134	0.010	≤0.001
	Trait-FoMO – state-FoMO – CIUS	0.309	0.018	≤0.001
Trait-FoMO R^2 = 0.189, State-FoMO R^2 = 0.409, CIUS R^2 = 0.509.				
b.		Male		
		β	*SE*	*p*
Direct	MHI-5 – Trait-FoMO	−0.444	0.028	≤0.001
	MHI-5 – State-FoMO	−0.046	0.034	0.172
	MHI-5 – CIUS	−0.331	0.031	≤0.001
	Trait-FoMO – State-FoMO	0.598	0.028	≤0.001
	Trait-FoMO – CIUS	0.066	0.038	0.078
	State-FoMO – CIUS	0.381	0.035	≤0.001
Indirect	MHI-5 – state-FoMO – CIUS	−0.018	0.013	0.168
	MHI-5 – trait-FoMO – CIUS	−0.029	0.017	0.0755
	MHI-5 – trait-FoMO – state-FoMO – CIUS	−0.101	0.013	≤0.001
	Trait-FoMO – state-FoMO – CIUS	0.227	0.025	≤0.001
Trait-FoMO R^2 = 0.197, State-FoMO R^2 = 0.384, CIUS R^2 = 0.388.				

Table 6. SEM coefficients for direct and indirect effects for female (6a) and male (6b) gamers

a.		Female		
		β	*SE*	*p*
Direct	MHI-5 – Trait-FoMO	−0.256	0.091	0.005
	MHI-5 – State-FoMO	0.130	0.095	0.173
	MHI-5 – CIUS	−0.190	0.084	0.024
	Trait-FoMO – State-FoMO	0.657	0.083	≤0.001
	Trait-FoMO – CIUS	0.302	0.129	0.019
	State-FoMO – CIUS	0.299	0.131	0.022
Indirect	MHI-5 – state-FoMO – CIUS	0.039	0.033	0.242
	MHI-5 – trait-FoMO – CIUS	−0.077	0.044	0.078
	MHI-5 – trait-FoMO – state-FoMO – CIUS	−0.050	0.029	0.081
	Trait-FoMO – state-FoMO – CIUS	0.197	0.089	0.027
Trait-FoMO R^2 = 0.066, State-FoMO R^2 = 0.405, CIUS R^2 = 0.364.				
b.		Male		
		β	*SE*	*p*
Direct	MHI-5 – Trait-FoMO	−0.399	0.039	≤0.001
	MHI-5 – State-FoMO	0.065	0.053	0.217
	MHI-5 – CIUS	−0.289	0.043	≤0.001
	Trait-FoMO – State-FoMO	0.571	0.043	≤0.001
	Trait-FoMO – CIUS	0.072	0.053	0.174
	State-FoMO – CIUS	0.403	0.053	≤0.001
Indirect	MHI-5 – state-FoMO – CIUS	0.026	0.022	0.231
	MHI-5 – trait-FoMO – CIUS	−0.029	0.021	0.175
	MHI-5 – trait-FoMO – state-FoMO – CIUS	−0.092	0.018	≤0.001
	Trait-FoMO – state-FoMO – CIUS	0.230	0.038	≤0.001
Trait-FoMO R^2 = 0.160, State-FoMO R^2 = 0.301, CIUS R^2 = 0.338.				

DISCUSSION

In the present study based on a large sale sample recruited through pro-active screening, we tested a theoretical model to explain the role of FoMO in developing IUD symptoms related to specific online activities. The proposed SEM explained 42.0% of the variance in IUD symptoms in the total sample, 46.8% for SNS users, and 32.8% for gamers. Results emphasize that impaired mental health and FoMO on social experiences as a stable individual characteristic increase the risk of experiencing IUD symptoms. Low mental health enhanced trait-FoMO, and trait-FoMO mediated the link between low mental health and IUD symptoms for both SNS users and gamers. State-FoMO mediated the impact of low mental health on addictive Internet use for gamers, as well as the link between trait-FoMO and IUD symptoms in both user groups. Keeping the small subsample sizes in mind, the results for the different gender groups are partly comparable, illustrating convergent mechanisms for male and female SNS users and gamers.

The results partially confirm the assumptions of the I-PACE model by Brand et al. (2016): core characteristics such as impaired mental health and trait-FoMO proved to predict diminished control over using the Internet, but the hypothesized mediating role of a cognitive bias (state-FoMO) during Internet use was only partly confirmed for the link

between impaired mental health and IUD symptoms. Comparing the results with the findings of Wegmann et al. (2017), for general Internet use and SNS use, we outline that state-FoMO affected IUD symptoms only through its link to trait-FoMO. This suggests that the fear of missing out on other people's online experiences is induced by a general fear of disconnection but not by symptoms of depression or anxiety. For SNS users specifically, state-FoMO on its own might not be as problematic as trait-FoMO since their temporary fear of being disconnected from other Internet users seems to induce problematic Internet use as a function of a more stable FoMO.

The general fear of disconnection, i.e. trait-FoMO, could be seen as part of the personality, which has also been included as a relevant predisposing characteristic in the I-PACE model (Brand et al., 2016). However, it can also be argued that trait-FoMO shares aspects with impaired mental health. As concluded by Wegmann et al. (2017), trait-FoMO appears to be a general need to belong. Our findings extend this conclusion by indicating that low mental health and trait-FoMO might share a fundamental need of connecting with others, characterized by potentially maladaptive assumptions, beliefs, and affects (e.g., "others are happier than me"). This resembles symptoms of depression and anxiety (Kovacs & Beck, 1978; Beck & Clark, 1988). Whether a personality dimension or a psychopathological symptom, trait-FoMO seems to be a core characteristic predisposing individuals to state-FoMO, leading to the development of IUD symptoms related to socially gratifying Internet use (Brand et al., 2016).

We conclude that the two types of FoMO are associated, but distinct constructs for explaining IUDs. Their distinction reflects in the wording of the assessment instrument: all items used to assess state-FoMO refer to the online context (e.g., "I am continuously online in order not to miss out on anything"), while the wording to assess trait-FoMO does not (e.g., "I fear my friends have more rewarding experiences than me"). The construction of the FoMO scale using factor analysis resulted in a stable two factor solution with high factor loadings (Wegmann et al., 2017). This illustrates the empirical difference between the two constructs.

We further extended the findings of Wegmann et al. (2017) by showing similarities between problematic SNS use and gaming in terms of underlying mechanisms. As hypothesized, both social networking and MMORPGs seem to fulfill the need to connect with others, which confirms the finding of Duman and Ozkara (2019).

FoMO seems to be a predictor and mediator of the problematic use of socially gratifying Internet activities. In turn, problematic Internet use may also enhance FoMO. (Mannion and Nolan (2020)) pointed out that FoMO creates anxiety when a person is aware of someone trying to contact their smartphone while being separated from it. This indicates that smartphone and Internet users have heightened anxiety due to being out of touch with others' experiences, which they reduce by using their phones more frequently. Through negative reinforcement, i.e. smartphone usage having a short term positive effect on their mood by reducing anxiety, smartphone and Internet users start checking their phones and social platforms more frequently to maintain the positive effect on their mood. However, the increased Internet use can have long term negative effects in real life (e.g., preoccupation, loss of control, conflicts), which are referred to as core symptoms of IUDs (Meerkerk et al., 2009). The Internet users' anxiety may even be a symptom of being withdrawn from their smartphone or the Internet. The permanent online activity makes users aware of the countless sources of information and communication used by others, which is likely to intensify FoMO and anxiety because of being confronted with potentially rewarding but missed experiences (Oberst et al., 2017). As shown by this study and others mentioned before, FoMO and anxiety then enhance IUD symptoms. Hence, FoMO, anxiety, and IUD symptoms may impact each other in a vicious cycle without clear causal direction, which has been discussed by several authors (Oberst et al., 2017; Vaidya, Jaiganesh, & Krishnan, 2016; Wegmann et al., 2017). Burnell, George, Vollet, Ehrenreich, and Underwood (2019) support this notion by finding that SNS use predicted social comparison, which was related to FoMO. FoMO, in turn, predicted depressive symptoms, and other variables such as impaired self-worth.

The I-PACE model by Brand et al. (2016) has also hypothesized these cyclical associations. The authors assume that IUDs intensify psychopathology (such as anxiety). Since our results indicate that psychopathology and trait-FoMO are associated in both being predisposing factors for IUDs, problematic Internet use may also intensify trait-FoMO. Also, according to Brand et al. (2016), the gratification of social needs via SNS use and gaming, for instance, reinforces Internet related cognitions (possibly including state-FoMO), which in turn impacts core characteristics such as psychopathology. Brand et al. (2016) also hypothesized a variety of other variables being involved in the development of IUDs (e.g., stress vulnerability, affective and cognitive responses). Future research could investigate the effect of IUD symptoms on FoMO in order to further explore the complex reinforcement processes between these variables.

Another difference between the present study and Wegmann et al. (2017) lies in the variable of psychopathology. We included it as a manifest variable assessed by a single measure of mental health, whereas Wegmann et al. (2017) used a latent dimension represented by the assessment of depression and interpersonal sensitivity (including social anxiety). While they refer to similar symptoms as the present study, the measures used by Wegmann et al. (2017) explicitly include interpersonal aspects. This is one reason why our results are only partially comparable to their results.

In this context, it is also noteworthy that our sample had a lower mean age than the sample of the study by Wegmann et al. (2017); 23.43 years). With the Internet being accessible at all times and offering an increasing variety of activities, students are constantly confronted with opportunities to miss out on rewarding experiences. Nowadays, connecting with others online is, to some extent, part of most Internet activities, which may explain our finding that the mechanisms of developing problematic SNS use and gaming are similar. The omnipresent social comparison online and the urge to stay updated may

also contribute to FoMO consolidating as a trait rather than a state already at a younger age. However, as Wegmann et al. (2017) have noted and as our results confirm, age does not seem to be related to the variables we investigated.

Limitations and strengths

There are limitations to our findings. The categorization of activity subsamples was based on a forced-choice question asking participants which one of ten Internet activities they mainly engaged in. Most participants engaged in more than one activity. CIUS scores might not only represent IUD symptoms associated with the one activity participants specified on the forced-choice question but also with their other online activities, so the classification is unreliable. This problem should be addressed in future studies.

Nonetheless, our results on different Internet activities can generate new hypotheses for studying IUDs. Future studies could use specific scales to quantify and compare specific IUDs, such as the ICD scale (Wegmann et al., 2015), the ten-item IGD test (Király et al., 2015), criteria for online shopping addiction (Rose & Dhandayudham, 2014), or the online gambling survey (Griffiths, Wood, & Parke, 2009).

Although the present study assumed directional effects between impaired mental health, FoMO and pathological Internet use, it is important to note that the results only reflect associations between the investigated variables. We provide cross-sectional data that do not allow for causal conclusions. Therefore, future research could focus on longitudinal data to examine causal effects between psychopathology, FoMO and IUDs.

Moreover, the subsample sizes of the two preferred activities were unequal. In addition, the subgroup of female gamers was substantially smaller than all other subgroups, so although the results on gender effects among Internet gamers provide hypotheses for further research, they need to be treated with caution. Future studies could focus on implementing more equally sized subsamples.

Another limitation is that self-report questionnaires were used to assess IUD symptoms and related variables. The CIUS only screens possible IUD symptoms. Future research could examine the development of IUDs using standardized clinical interviews that assess the number of fulfilled criteria for an IUD based on the DSM-5 criteria for IGD (American Psychiatric Association, 2013).

At the same time, this large-scale study provides increased statistical power compared to many other studies on FoMO. In addition, the sample is not biased by self-selection, which is the case when recruiting online-samples.

CONCLUSION AND PRACTICAL IMPLICATIONS

The present study extended previous research on the role of FoMO in IUDs by comparing the two common Internet activities social networking and gaming. Our results have implications for prevention and therapy. Prevention programs could emphasize real-life interactions as a more functional and sustainable way to gratify the need to belong in contrast to online communication, gaming, or video-watching (Kraut et al., 1998). Addressing the problem of constant upward social comparison should also be part of preventing problematic Internet use. Internet users should be educated about the paradox effect on mental health of attempting to use the Internet for meaningful connections: as pointed out by Burnell et al. (2019), SNS use promotes social comparison, which is related to FoMO and feelings of depression, envy, or resentment.

Online-specific cognitive biases, individual needs for social connection and personality traits related to them could be assessed and targeted in cognitive behavioral therapy (Du, Jiang, & Vance, 2010). Real-life activities to satisfy social or entertainment needs in place of Internet use should be determined and tested out individually. This way, the feeling of missing out on something could be identified and effectively reduced.

Funding sources: The project was supported by the German Federal Ministry of Health.

Author's contribution: DR: data gathering, statistical analyses and interpretation of findings, preparation of manuscript draft; GB: study supervision, study concept and design, obtained funding; DB: statistical analysis and interpretation of findings; AB: study concept and design, preparation of statistical analysis; SO: data gathering; layout for manuscript draft; BB: data gathering; EW: statistical analysis and interpretation of findings, review of manuscript draft; MB: statistical analysis, review of manuscript draft; HJR: study supervision, study concept and design, obtained funding. All authors had full access to all data of the study and take responsibility for the integrity of the data as well as for the accuracy of the data analysis. There was no editorial direction or censorship from sponsors.

Conflict of interest: The authors declare no conflict of interest.

REFERENCES

Alt, D. (2015). College students' academic motivation, media engagement and fear of missing out. *Computers in Human Behavior*, *49*, 111–119. http://dx.doi.org/10.1016/j.chb.2015.02.057.

American Psychiatric Association (2013). Diagnostic and statistical manual of mental disorders (5th ed.). Washington DC: APA.

Balta, S., Emirtekin, E., Kircaburun, K., & Griffiths, M. D. (2020). Neuroticism, trait fear of missing out, and phubbing: The mediating role of state fear of missing out and problematic Instagram use. *International Journal of Mental Health and Addiction*, *18*(3), 628–639. https://doi.org/10.1007/s11469-018-9959-8.

Baron, R. M., & Kenny, D. A. (1986). The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of*

Personality and Social Psychology, *51*(6), 1173. https://doi.org/10.1037//0022-3514.51.6.1173.

Beck, A. T., & Clark, D. A. (1988). Anxiety and depression: An information processing perspective. *Anxiety Research*, *1*(1), 23–36. https://doi.org/10.1080/10615808808248218.

Berwick, D. M., Murphy, J. M., Goldman, P. A., Ware, J. E., Jr., Barsky, A. J., & Weinstein, M. C. (1991). Performance of a five-item mental health screening test. *Medical Care*, 169–176. https://doi.org/10.1097/00005650-199102000-00008.

Brand, M., Rumpf, H. J., Demetrovics, Z., Müller, A., Stark, R., King, D. L., ... Potenza, M. N. (2020). Which conditions should be considered as disorders in the International Classification of Diseases (ICD-11) designation of "other specified disorders due to addictive behaviors"? *Journal of Behavioral Addictions*, *9*(2). https://doi.org/10.1556/2006.2020.00035.

Brand, M., Wegmann, E., Stark, R., Müller, A., Wölfling, K., Robbins, T. W., & Potenza, M. N. (2019). The Interaction of Person-Affect-Cognition-Execution (I-PACE) model for addictive behaviors: Update, generalization to addictive behaviors beyond internet-use disorders, and specification of the process character of addictive behaviors. *Neuroscience and Biobehavioral Reviews*, *104*, 1–10. https://doi.org/10.1016/j.neubiorev.2019.06.032.

Brand, M., Young, K. S., Laier, C., Wölfling, K., & Potenza, M. N. (2016). Integrating psychological and neurobiological considerations regarding the development and maintenance of specific Internet-use disorders: An Interaction of Person-Affect-Cognition-Execution (I-PACE) model. *Neuroscience and Biobehavioral Reviews*, *71*, 252–266. http://dx.doi.org/10.1016/j.neubiorev.2016.08.033.

Bullinger, M. (1995). German translation and psychometric testing of the SF-36 health survey: Preliminary results from the IQOLA project. *Social Science & Medicine*, *41*(10), 1359–1366. https://doi.org/10.1016/0277-9536(95)00115-N.

Burnell, K., George, M. J., Vollet, J. W., Ehrenreich, S. E., & Underwood, M. K. (2019). Passive social networking site use and well-being: The mediating roles of social comparison and the fear of missing out. *Cyberpsychology: Journal of Psychosocial Research on Cyberspace*, *13*(3). https://doi.org/10.5817/CP2019-3-5.

Chotpitayasunondh, V., & Douglas, K. M. (2016). How "phubbing" becomes the norm: The antecedents and consequences of snubbing via smartphone. *Computers in Human Behavior*, *63*, 9–18. http://dx.doi.org/10.1016/j.chb.2016.05.018.

Cohen, J. (1988). Statistical power analysis for the behavioral sciences. Hilsdale. NJ: Lawrence Earlbaum Associates, Vol. *2*.

Cole, H., & Griffiths, M. D. (2007). Social interactions in massively multiplayer online role-playing gamers. *CyberPsychology & Behavior*, *10*(4), 575–583. https://doi.org/10.1089/cpb.2007.9988.

Downing, M. J., Antebi, N., & Schrimshaw, E. W. (2014). Compulsive use of internet-based sexually explicit media: Adaptation and validation of the compulsive internet use scale (CIUS). *Addictive Behaviors*, *39*(6), 1126–1130. https://doi.org/10.1016/J.ADDBEH.2014.03.007.

Du, Y., Jiang, W., & Vance, A. (2010). Longer term effect of randomized, controlled group cognitive behavioural therapy for internet addiction in adolescent students in Shanghai. *The Australian and New Zealand Journal of Psychiatry*, *44*(2), 129–134. https://doi.org/10.3109/00048670903282725.

Duman, H., & Ozkara, B. Y. (2019). The impact of social identity on online game addiction: The mediating role of the fear of missing out (FoMO) and the moderating role of the need to belong. *Current Psychology*, 1–10. https://doi.org/10.1007/s12144-019-00392-w.

Gil, F., Chamarro, A., & Oberst, U. (2015). Addiction to online social networks: A question of "Fear of Missing Out"? *Journal of Behavioral Addictions*, *4*(S1), 51–52.

Griffiths, M. D., Wood, R. T. A., & Parke, J. (2009). Social responsibility tools in online gambling: A survey of attitudes and behavior among internet gamblers. *CyberPsychology & Behavior*, *12*(4), 413–421. https://doi.org/10.1089/cpb.2009.0062.

Guertler, D., Rumpf, H. J., Bischof, A., Kastirke, N., Petersen, K. U., John, U., & Meyer, C. (2014). Assessment of problematic internet use by the compulsive internet use scale and the internet addiction test: A sample of problematic and pathological gamblers. *European Addiction Research*, *20*(2), 75–81. https://doi.org/10.1159/000355076.

Hu, L., & Bentler, P. M. (1995). Evaluating model fit. In R. H. Hoyle (Ed.), *Structural equation modeling concepts issues and applications* (pp. 76-99). London: Sage Publications, Inc.

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, *6*, 1–55. https://doi.org/10.1080/10705519909540118.

Internet World Stats (2020). Retrieved from https://www.internetworldstats.com/stats.htm, accessed on 15/08/2020.

Khazaal, Y., Chatton, A., Horn, A., Achab, S., Thorens, G., Zullino, D., & Billieux, J. (2012). French validation of the compulsive internet use scale (CIUS). *Psychiatric Quarterly*, *83*(4), 397–405. https://doi.org/10.1007/s11126-012-9210-x.

Király, O., Sleczka, P., Pontes, H. M., Urbán, R., Grif, M. D., & Demetrovics, Z. (2015). Validation of the ten-item internet gaming disorder test (IGDT-10) and evaluation of the nine DSM-5 internet gaming disorder criteria. *Addictive Behaviors*, *64*, 253–260. https://doi.org/10.1016/j.addbeh.2015.11.005.

Kovacs, M., & Beck, A. T. (1978). Maladaptive cognitive structures in depression. *American Journal of Psychiatry*, *135*(5), 525–533. https://doi.org/10.1176/ajp.135.5.525.

Kraut, R., Patterson, M., Lundmark, V., Kiesler, S., Mukopadhyay, T., & Scherlis, W. (1998). Internet paradox. *American Psychologist*, *53*(9), 1017–1031. https://doi.org/10.1037//0003-066x.53.9.1017.

Kuss, D., Griffiths, M., Karila, L., & Billieux, J. (2014). Internet addiction: A systematic review of epidemiological research for the last decade. *Current Pharmaceutical Design*, *20*(25), 4026–4052. https://doi.org/10.2174/13816128113199990617.

Kuss, D. J. (2013). Internet gaming addiction: Current perspectives. *Psychology Research and Behavior Management*, 125–137. Retrieved from http://ovidsp.ovid.com/ovidweb.cgi?T=JS&CSC=Y&NEWS=N&PAGE=fulltext&D=psyc10&AN=2014-27050-001.

Kuss, D. J., & Griffiths, M. D. (2011). Online social networking and addiction—a review of the psychological literature. *International Journal of Environmental Research and Public Health*, *8*(9), 3528–3552. https://doi.org/10.3390/ijerph8093528.

Kuss, D. J., & Griffiths, M. D. (2012). Internet gaming addiction: A systematic review of empirical research. *International Journal of*

Mental Health and Addiction, *10*(2), 278–296. https://doi.org/10.1007/s11469-011-9318-5.

Kuss, D. J., & Griffiths, M. D. (2017). Social networking sites and addiction: Ten lessons learned. *International Journal of Environmental Research and Public Health*, *14*(3), 311. http://doi.org/10.3390/ijerph14030311.

Little, T. D., Cunningham, W. A., Shahar, G., & Widaman, K. F. (2002) To parcel or not to parcel: Exploring the question, weighing the merits. *Structural Equation Modelling*, *9*:151–173. https://doi.org/10.1207/S15328007SEM0902_1.

Mannion, K. H., & Nolan, S. A. (2020). The effect of smartphones on anxiety: An attachment issue or fear of missing out? *Cogent Psychology*, *7*(1). https://doi.org/10.1080/23311908.2020.1869378.

Marsh, H. W., Lüdtke, O., Nagengast, B., Morin, A. J., & von Davier M. (2013). Why item parcels are (almost) never appropriate: Two wrongs do not make a right camouflaging misspecification with item parcels in CFA models. *Psychological Methods*, *18*: 257–284. https://doi.org/10.1037/a0032773.

Meerkerk, G. J., Van Den Eijnden, R., Vermulst, A. A., & Garretsen, H. F. L. (2009). The compulsive internet use scale (CIUS): Some psychometric properties. *Cyberpsychology & Behavior*, *12*(1), 1–6. https://doi.org/10.1089/cpb.2008.0181.

Muthén, L., & Muthén, B. (2011). *MPlus*. Los Angeles: Muthén & Muthén.

Oberst, U., Wegmann, E., Stodt, B., Brand, M., & Chamarro, A. (2017). Negative consequences from heavy social networking in adolescents: The mediating role of fear of missing out. *Journal of Adolescence*, *55*, 51–60. http://dx.doi.org/10.1016/j.adolescence.2016.12.008.

Pavot, W., & Diener, E. (1993). Review of the satisfaction with life scale. *Psychological Assessment*, *5*(2), 164–172. https://doi.org/10.1007/978-90-481-2354-4_5.

Przybylski, A. K., Murayama, K., DeHaan, C. R., & Gladwell, V. (2013). Motivational, emotional, and behavioral correlates of fear of missing out. *Computers in Human Behavior*, *29*, 1841–1848. http://dx.doi.org/10.1016/j.chb.2013.02.014.

Rose, S., & Dhandayudham, A. (2014). Towards an understanding of Internet-based problem shopping behaviour: The concept of online shopping addiction and its proposed predictors. *Journal of Behavioral Addictions*, *3*(2), 83–89. https://doi.org/10.1556/JBA.3.2014.003.

Rumpf, H. J., Meyer, C., Hapke, U., & John, U. (2001). Screening for mental health: Validity of the MHI-5 using DSM-IV Axis I psychiatric disorders as gold standard. *Psychiatry Research*, *105*(3), 243–253. https://doi.org/10.1016/s0165-1781(01)00329-8.

Rumpf, H. J., Vermulst, A. A., Bischof, A., Kastirke, N., Gürtler, D., Bischof, G., ... Meyer, C. (2014). Occurence of internet addiction in a general population sample: A latent class analysis. *European Addiction Research*, *20*, 159–166. https://doi.org/10.1159/000354321.

Shaw, M., & Black, D. W. (2008). Internet addiction. *CNS Drugs*, *22*(5), 353-365.

Starcke, K., & Brand, M. (2016). Effects of stress on decisions under uncertainty: A meta-analysis. *Psychological Bulletin*, *142*(9), 909–933. https://doi.org/10.1037/bul0000060.

Sun, P., Johnson, C. A., Palmer, P., Arpawong, T. E., Unger, J. B., Xie, B., ... Sussman, S. (2012). Concurrent and predictive relationships between compulsive internet use and substance use: Findings from vocational high school students in China and the USA. *International Journal of Environmental Research and Public Health*, *9*(3), 660–673. https://doi.org/10.3390/ijerph9030660.

Tavolacci, M. P., Ladner, J., Grigioni, S., Richard, L., Villet, H., & Dechelotte, P. (2013). Prevalence and association of perceived stress, substance use and behavioral addictions: A cross-sectional study among university students in France, 2009–2011. *BMC Public Health*, *13*(1), 724–732. https://doi.org/10.1186/1471-2458-13-724.

Vaidya, N., Jaiganesh, S., & Krishnan, J. (2016). Prevalence of Internet addiction and its impact on the physiological balance of mental health. *National Journal of Physiology, Pharmacy and Pharmacology*, *6*(1), 97–100. https://doi.org/10.5455/njppp.2015.5.0511201588.

Van Rooij, A. J., Schoenmakers, T. M., Vermulst, A. A., Van Den Eijnden, R. J., & Van De Mheen, D. (2011). Online video game addiction: Identification of addicted adolescent gamers. *Addiction*, *106*(1), 205–212. https://doi.org/10.1111/j.1360-0443.2010.03104.x.

Wartberg, L., Petersen, K. K.-U., Kammerl, R., Rosenkranz, M., & Thomasius, R. (2014). Psychometric validation of a German version of the compulsive internet use scale. *Cyberpsychology, Behavior and Social Networking*, *17*(2), 99–103. https://doi.org/10.1089/cyber.2012.0689.

Wegmann, E., & Brand, M. (2016). Internet-communication disorder: It's a matter of social aspects, coping, and internet-use expectancies. *Frontiers in Psychology*, *7*, 1747. https://doi.org/10.3389/fpsyg.2016.01747.

Wegmann, E., Oberst, U., Stodt, B., & Brand, M. (2017). Online-specific fear of missing out and Internet-use expectancies contribute to symptoms of Internet-communication disorder. *Addictive Behaviors Reports*, *5*, 33–42. https://doi.org/10.1016/j.abrep.2017.04.001.

Wegmann, E., Stodt, B., & Brand, M. (2015). Addictive use of social networking sites can be explained by the interaction of Internet use expectancies, Internet literacy, and psychopathological symptoms. *Journal of Behavioral Addictions*, *4*, 155–162. http://dx.doi.org/10.1556/2006.4.2015.021.

World Health Organization. (2018). *ICD-11 for Mortality and Morbidity Statistics. Mental, behavioural or neurodevelopmental disorders*. Retrieved August 30, 2020, from https://icd.who.int/browse11/l-m/en.

Yong, R. K. F., Inoue, A., & Kawakami, N. (2017). The validity and psychometric properties of the Japanese version of the Compulsive Internet Use Scale (CIUS). *BMC Psychiatry*, *17*(1), 1–12. https://doi.org/10.1186/s12888-017-1364-5.