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Title: The Relationship Between Personality Traits, Psychopathological Symptoms, and Problematic Internet Use: A Complex Mediation Model

AUTHORS: BEATRIX KORONCZAI, PH.D.<sup>1</sup>, GYÖNGYI KÖKÖNYEI, PH.D.<sup>2</sup>, MARK D. GRIFFITHS, PH.D.<sup>3</sup>, ZSOLT DEMETROVICS, PH.D.<sup>2</sup>

<sup>1</sup> Department of Developmental and Clinical Child Psychology, Institute of Psychology, Eötvös Loránd University, Budapest, Hungary

<sup>2</sup> Department of Clinical Psychology and Addictology, Institute of Psychology, Eötvös Loránd University, Budapest, Hungary

<sup>3</sup> Psychology Division, Nottingham Trent University, Nottingham, United Kingdom

Corresponding author: Beatrix Koronczai

Eötvös Loránd University, Institute of Psychology,

Department of Developmental and Clinical Child Psychology

Izabella utca 46., H-1064, Budapest, HUNGARY

Phone: +36 70 2834 051; Fax: +36 1 461 2697;

Email: [koronczai.beatrix@ppk.elte.hu](mailto:koronczai.beatrix@ppk.elte.hu)

## ABSTRACT

*Background and objective:* There are many empirical studies that demonstrate the associations between problematic internet use, psychopathological symptoms, and personality traits. However, complex models are scarce. To address this gap, the aim of the present study was to build and test a mediation model based on these factors.

*Methods:* Data were collected from a medical addiction center (43 internet addicts) and internet cafés (222 customers) in Beijing (Mean age = 22.45 years, SD = 4.96; 90.2% males). Path analysis was applied to test the mediation models using structural equation modelling.

*Results:* Based on the preliminary analyses (correlations and linear regression), two different models were built. In the first model, low conscientiousness and depression had a direct significant influence on problematic internet use. The indirect effect of conscientiousness – via depression – was non-significant. Emotional stability only affected problematic internet use indirectly, via depressive symptoms. In the second model, low conscientiousness also had a direct influence on problematic internet use, while the indirect path via the Global Severity Index was again non-significant. Emotional stability impacted problematic internet use indirectly via the Global Severity Index, while it had no direct effect on it, as in the first model.

*Conclusion:* Personality traits (i.e., conscientiousness as a protective factor and neuroticism as a risk factor) play a significant role in problematic internet use, both directly and indirectly (via distress level).

## INTRODUCTION

To date, most empirical studies have found a positive association between problematic internet use (PIU) and psychopathological symptoms both in normal samples of adolescents [1-5] and adults [6-11]. A few studies have examined this relationship among clinical samples (i.e., among diagnosed internet addicts), comparing them to healthy control groups [2, 12, 13] or clinical control groups [14, 15]. The results of sampling from both clinical and normal population has demonstrated an increased level of psychopathological symptoms. When predictor variables have been examined for problematic internet use, findings have also been consistent. In the majority of studies, *depressive* [1, 14, 10, 12, 13, 5, 15] and *obsessive-compulsive* symptoms [8, 1, 9, 14, 13, 4, 15] have been found to be the most significant predictors of problematic internet use.

Additionally, several studies have reported important predictors of problematic internet use (or they are present at a more extensive level in the group of problematic internet users) including *hostility* [1, 9, 13, 4, 5], *anxiety* [10, 12, 5, 13] and *interpersonal sensitivity* [8, 1, 15]. One longitudinal study (i.e., [16]) has provided indicative data concerning the cause-and-effect between problematic internet use and psychopathological symptoms. The results suggested that obsessive-compulsive symptoms are predictors of internet addiction, while an increased level of depression, anxiety, hostility, interpersonal sensitivity, and psychoticism are consequences of internet addiction.

Regarding personality traits, a meta-analysis by Kayis et al. [17] evaluating 12 studies found that all the five main factors of the Big Five model correlated with problematic internet use. More specifically, agreeableness, openness to experience, extraversion and conscientiousness were negatively associated with internet addiction, whereas neuroticism was positively associated with internet addiction. In general, the relationship between neuroticism and problematic internet use appears the most established. Neuroticism has been positively associated with (i) problematic internet use in all empirical research to date in correlational studies (e.g., [18-20]), (ii) comparison of groups of internet addicts and controls (e.g., [21, 22]), and (iii) regression analyses (e.g., [23, 19]). This association is also found in research assessing neuroticism by questionnaires based on (i) Eysenck's three-factor theory (e.g., [24-33]) and (ii) Zuckerman's five-factor model (e.g., [34]). Similarly, studies have also reported an association between low agreeableness and internet addiction (e.g., [21, 23, 18, 20]) and low conscientiousness and internet addiction (e.g., [18, 22, 20]).

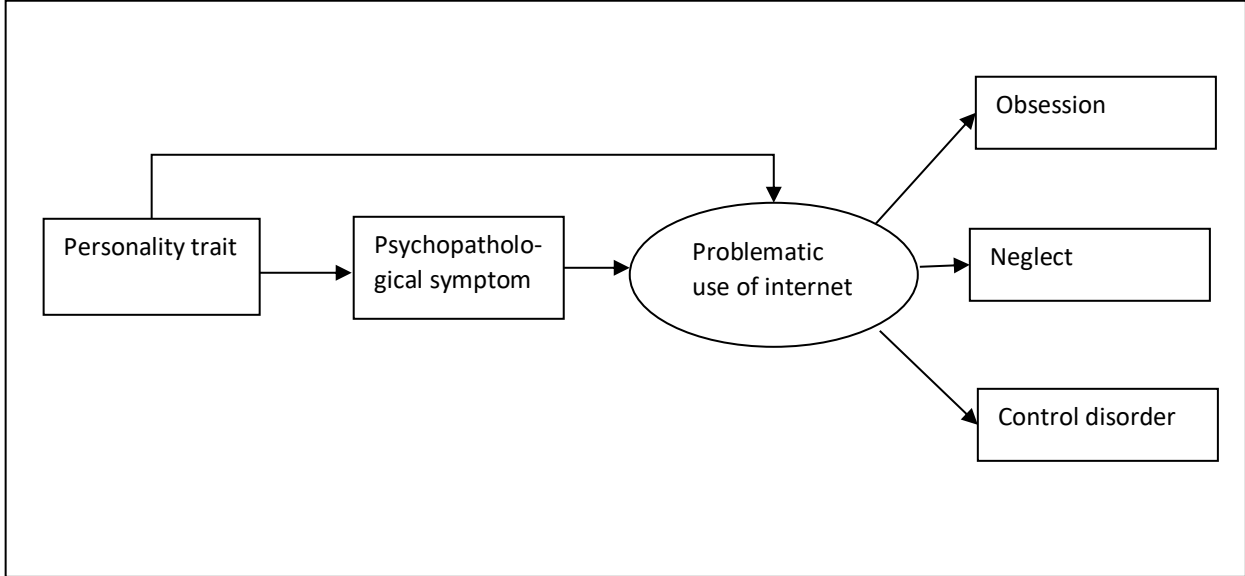
The direction of association between extraversion and problematic internet use is controversial. Some studies have demonstrated a positive relationship with more symptoms of internet addiction being associated with higher extraversion (e.g., [21, 18, 20]). However, another study reported a negative association with a higher level of problematic internet use being correlated with higher introversion [22]. Regarding Eysenck's three-factor model, introversion has also been related to problematic internet use in some cases (e.g., [35, 25, 13, 31]). Additionally, Zuckerman's *sociability* and *activity* factors (which may correspond with extraversion), have also been found to correlate negatively with internet addiction [34]. Similar incoherence has been found in the case of the openness to experience. One study reported an association between problematic internet use and low openness to experience [21], whereas another reported a positive association between internet addiction and openness to experience [21].

To date, there have been relatively few mediation or moderation models examining the complex associations and interactions between personality traits, internet addiction, and other variables. Researchers have examined the associations between specific personality traits and problematic internet use via coping strategies [21]. Additionally, personality traits have been shown to mediate the impact of time spent online on internet addiction [36]. Kuss, Griffiths and Binder [23] also demonstrated that the interactions between different online activities and personality traits have an effect on the likelihood of becoming an internet addict.

To the authors' knowledge, only two studies have tested complex models including variables comprising personality, psychopathology, and problematic internet use. One of them (i.e., [37]) presented a model where personality was characterized in the terms of the Behavioral Inhibition System (BIS) and the Behavioral Activation System (BAS), and depression, impulsivity, and anxiety were considered as psychopathologies. The study found that both personality variables influenced internet addiction, and that the effect was mediated by anxiety and/or depression and/or impulsivity in different ways. Floros et al. [38] described a path model analysis, where personality traits were conceptualized by Zuckerman's alternative five-factor model, and psychopathological symptoms were assessed using the global indexes of the 90-item Symptom Checklist (SCL-90). In this model, personality traits and defense style both had an effect on internet addiction, and internet addiction predicted the psychopathological symptoms (rather than the reverse).

In summary, there are many empirical studies that demonstrate associations between internet addiction and psychopathological symptoms, as well as between internet addiction and personality traits. However, further analysis is needed on the complex effects and models. Given the lack of research, the aim of the present study was to build and test a mediation model that examined personality factors, psychopathological symptoms, and problematic internet use within a single complex model (see Figure 1). The investigation of complex effects is relevant in particular for problematic internet users because the outcomes might facilitate the focus of their treatment.

Figure 1. Proposed mediation model



METHODS

*Participants and procedure*

The data for the present sample were collected from two samples of intensive users of internet. Although the two samples appear to be distinct, this sampling method can be explained by specific Chinese circumstances. In an internet addiction clinic, the patients are not a simple treatment-seeking population, because the young internet users often are delegated (and sometimes forced) to enter treatment by their parents. In internet cafés, based on some prior reports (see: [39, 40]), intensive users with a high risk for problematic internet use can be found. Sample 1 (the clinical group) comprised diagnosed internet addicts who were hospitalized at an addiction medical center in Beijing specialized in the treatment of problematic internet users. Each patient admitted to the hospital and diagnosed for problematic internet use was included in the sample during the nine months of the study period. In the case of patients under 18 years, both the patients and their parents were informed about the study goals and were asked to provide informed consent. Participation was voluntary, and the questionnaires were completed anonymously. Sample 2 (the internet café group) comprised customers of internet cafés in the Chaoyang District of Beijing. Managers of 15 internet cafés were asked for permission to carry out the data collection, and 13 agreed. Each of the 13 cafés were visited three times. During data collection, each customer was invited to participate in the study and approximately 10% agreed to participate. A small gift was offered as recompense for participation in the study (i.e., money for two-hour internet use or a soft drink) was offered. The customers completed the questionnaires on site but via an online survey. Participation in the research was voluntary and anonymous. The participants could read information about the study and provide informed consent prior to completing the questionnaire. The study protocol was approved by the Institutional Review Board of the research team's university. The final sample comprised 43 diagnosed internet addicts (42 males, one female) and 222 internet café customers (197 males, 25 females). The mean age was 22.45 years (SD = 4.96) in the total sample, 17.9 years in the clinical group (SD=0.42), and 34.47 years in the internet café group (SD = 4.76). The age difference between the two samples was statistically significant ( $t = 10.056$ ;  $P < .001$ ).

### *Measures*

*Demographic data and internet use characteristics.* Basic personal demographic information and other questions were asked about the location, the duration, the frequency and the purpose of internet use.

*Problematic Internet Use Questionnaire-9 (PIUQ-9).* The Chinese version of Problematic Internet Use Questionnaire [41] comprises three factors (Obsession, Neglect, Control disorder) with three items relating to each factor. The Obsession subscale relates to mental withdrawal symptoms caused by the lack of internet use (e.g., *How often do you feel tense, irritated, or stressed if you cannot use the Internet for as long as you want to?*). The Neglect subscale contains items related to difficulties in controlling internet use (e.g., *How often do you spend time online when you'd rather sleep?*). The Control disorder subscale relates to difficulties in controlling internet use (e.g., *How often do you try to conceal the amount of time spent online?*). Participants use a 5-point Likert scale to estimate the extent to which each given statement is true to them. The scale ranges from 9-45; on the subscales the maximum scores are 15. Higher scores indicate more symptoms of problematic internet use.

*Big Five Mini-Markers.* This scale [42] is a shortened version of Goldberg's scale [43] and comprises 40 adjectives. Participants evaluate every adjective according to how well it describes them on a 9-point Likert scale. It has five factors which assess the participants' overall personality (i.e., Extraversion, Agreeableness, Conscientiousness, Emotional stability, and Intellect/Openness). In all the subscales, higher scores indicate a higher level of the specific personality characteristic that is named in the label of subscale. The maximum score on each subscale is 72.

*Brief Symptom Inventory.* This scale [44] is a shortened version of the Symptom Checklist-90-R [45]. It comprises 53 items and participants assess how much the symptoms bothered them the previous week on a 5-point Likert scale. The scale lists the clinically relevant psychological symptoms that are indicators of emotional distress. The items include nine dimensions: somatization, obsessive-compulsive symptoms, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoia, and psychoticism. For all the subscales, higher scores indicate more psychopathological symptoms. In addition, one of global indices was used, namely Global Severity Index which is the mean of all the items. The maximum score on ‘Interpersonal sensitivity’ subscale is 20; 25 on ‘Hostility’, ‘Phobic anxiety’, ‘Paranoid ideation’ and ‘Psychoticism’; 30 on ‘Obsessive-compulsive symptoms’, ‘Depression’ and ‘Anxiety’; 35 on ‘Somatization’ and 5 on ‘GSI’.

### *Statistical analysis*

SPSS 23.0 and Mplus 7.11 statistical software packages were used for statistical analyses. In addition to the mean and standard deviation of the scales, Cronbach’s alphas ( $\alpha$ ) were calculated as indices of internal consistency, which were considered good if the values were at least 0.70 [46]. Correlational analysis and regression analysis were also applied. Based on these results, path analysis was used to test the mediation models with structural equation modelling (SEM) using maximum likelihood estimation robust to non-normality (MLR) [47]. To evaluate the overall fit of the models, the absolute fit index ( $\chi^2$ ), the comparative fit index (CFI), the Tucker–Lewis index or non-normed fit index (TLI), and the root mean square error approximation (RMSEA) were used. CFI and TLI are related to the total variance accounted by the model, with values higher than 0.95 indicating a good fit, and values below 0.90 indicating a poor fit [48]. RMSEA is related to the variance of the residuals, and values below 0.08 are considered an acceptable fit, while values below .05 indicate a good fit. Closeness of model fit using RMSEA (CFI of RMSEA) evaluating the statistical deviation of RMSEA from the value .05 is also reported. Non-significant probability values ( $P > .05$ ) indicate acceptable fit. However, some methodologists suggest values larger than  $P > .50$  [48].

## RESULTS

### *Descriptive statistics*

To describe the characteristics of internet use in the sample, the time spent on internet for the purpose of studying/working is presented in Table 1. Around one-third of the sample used the internet for studying/working 3-4 hours a day. This represented the largest category out of the six options given among all internet use. Around 10% of the participants declared that they spent more than eight hours a day online for the purpose of studying/working. Table 1 also shows the time spent on the internet for purposes other than studying/working. The pattern was similar. Two-thirds of the participants used the internet for entertainment 1-2 hours or 3-4 hours a day, and a little bit less than 10% used the internet for entertainment for more than eight hours a day.

Table 1. Time spent on the internet for working/studying and other purposes.

	How many hours does the participant use internet for working/studying? (Percent of participants)	How many hours does the participant use internet for other purposes? (Percent of participants)

Maximum 1 hour a day	22.5	14.2
1-2 hours a day	19.8	31.4
3-4 hours a day	27.9	31.0
5-6 hours a day	9.9	10.3
7-8 hours a day	8.0	4.2
More than 8 hours a day	11.8	8.8

The clinical group reported higher total PIUQ score and higher scores on the Neglect factor than the internet café group. Also, a significant difference was found between the clinical group and the internet café group according to BFI Intellect/Openness (see Table 2). The effect size for differences in the total PIUQ score and for the Neglect factor was small (Cohen's  $d$  were 0.41 and 0.38, respectively) but large in magnitude for Intellect/Openness (Cohen's  $d = 0.87$ ).

Table 2. Means (standard deviations) and differences by groups with Cronbach's alphas

Scale	Cronbach's alpha	Mean (SD) Total sample	Mean (SD) Clinical group	Mean (SD) Internet café group	$t$ values
PIUQ-9 Total	.848	20.10 (8.16)	23.15 (9.75)	19.53 (7.73)	2.223 <sup>a</sup>
PIUQ-9 Obsession	.749	5.74 (3.09)	6.28 (3.55)	5.63 (2.98)	1.262
PIUQ-9 Neglect	.713	7.20 (3.14)	5.63 (3.47)	6.87 (3.01)	3.966 <sup>b</sup>
PIUQ-9 Control	.886	7.12 (3.03)	7.79 (3.67)	7.00 (2.88)	1.554
BSI Somatization	.840	9.80 (3.95)	9.71 (3.59)	9.81 (4.03)	0.157
BSI Obsessive-compulsive	.817	10.77 (4.54)	10.29 (4.07)	10.86 (4.64)	0.730
BSI Interpersonal sensitivity	.791	7.38 (3.59)	6.93 (3.09)	7.47 (3.68)	0.884
BSI Depression	.871	10.11 (5.00)	9.66 (3.86)	10.21 (5.20)	0.777
BSI Anxiety	.826	8.51 (3.75)	8.88 (3.84)	8.44 (3.74)	0.688
BSI Hostility	.790	7.85 (3.39)	8.22 (3.23)	7.78 (3.42)	0.759
BSI Phobic anxiety	.712	7.13 (3.04)	6.88 (2.53)	7.18 (3.14)	0.582
BSI Paranoid ideation	.772	7.68 (3.30)	7.74 (3.26)	7.67 (3.32)	0.140
BSI Psychoticism	.775	7.73 (3.46)	8.07 (3.68)	7.66 (3.42)	0.694
GSI Global Severity Index	.970	1.57 (0.60)	1.56 (0.54)	1.58 (0.61)	0.145
BFI Extraversion	.540	43.95 (7.87)	44.98 (10.83)	43.74 (7.14)	0.707
BFI Agreeableness	.711	51.24 (8.79)	53.02 (9.73)	50.88 (8.57)	1.441
BFI Conscientiousness	.712	44.20 (8.68)	44.69 (10.35)	44.10 (8.33)	0.349
BFI Emotional Stability	.734	45.61 (9.78)	47.05 (12.60)	45.32 (9.12)	0.845
BFI Intellect/Openness	.734	46.03 (8.87)	52.43 (9.33)	44.73 (8.20)	5.412 <sup>b</sup>

Note. PIUQ-9 Total: Sum score of the Problematic Internet Use Questionnaire. BSI: Brief Symptom Inventory.

BFI: Big Five Inventory.

a:  $P < .05$ , b:  $P < .001$

Correlations between the variables of the study are reported in Table 3.

Table 3. Correlations between the PIUQ and the subscales of BSI and BFI.

Scales	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. PIUQ-9 Total	.268	.395	.312	.404	.308	.336	.274	.247	.315	.380	-.107	-.101	-.366	-.293	-.053
2. BSI Somatization	1	.628	.596	.682	.778	.623	.687	.654	.689	.833	-.257	-.245	-.253	-.289	-.145
3. BSI Obsessive-compulsive		1	.720	.738	.650	.700	.667	.638	.707	.841	-.343	-.157	-.402	-.353	-.143
4. BSI Interpersonal sensitivity			1	.762	.700	.679	.699	.705	.707	.844	-.271	-.125	-.277	-.375	-.056
5. BSI Depression				1	.763	.680	.700	.707	.802	.897	-.282	-.224	-.345	-.377	-.119
6. BSI Anxiety					1	.644	.758	.706	.776	.887	-.314	-.251	-.274	-.365	-.119
7. BSI Hostility						1	.708	.723	.683	.827	-.225	-.296	-.270	-.362	-.045
8. BSI Phobic anxiety							1	.728	.717	.855	-.355	-.269	-.265	-.395	-.137
9. BSI Paranoid ideation								1	.762	.846	-.301	-.285	-.241	-.439	-.033
10. BSI Psychoticism									1	.886	-.285	-.219	-.263	-.355	-.030
11. BSI Global Severity Index										1	-.333	-.260	-.344	-.428	-.105
12. BFI Extraversion											1	.465	.418	.474	.425
13. BFI Agreeableness												1	.454	.531	.449
14. BFI Conscientiousness													1	.493	.475
15. BFI Emotional Stability														1	.220
16. BFI Intellect/Openness															1

Note. PIUQ-9 Total: Sum score of the Problematic Internet Use Questionnaire. BSI: Brief Symptom Inventory. BFI: Big Five Inventory. Correlations above |.219| are significant at  $P < .001$ .

Based on previous results [49], 22 points (out of 40) was defined as a cut-off point of PIUQ-9 and created two categories of internet users (problematic and non-problematic users) The proportion of problematic internet users was 37.3% in the clinical group and 31.9% in the internet café group. Applying linear regression, symptoms which remained in significant relationships were tested with problematic internet use (which was a continuous variable) after controlling for the effects on each other. Besides the sample category that the participants were in, the increased levels of obsessive-compulsive as well as depressive symptoms contributed significantly to an explanation of the variance of total scores (see Table 4).



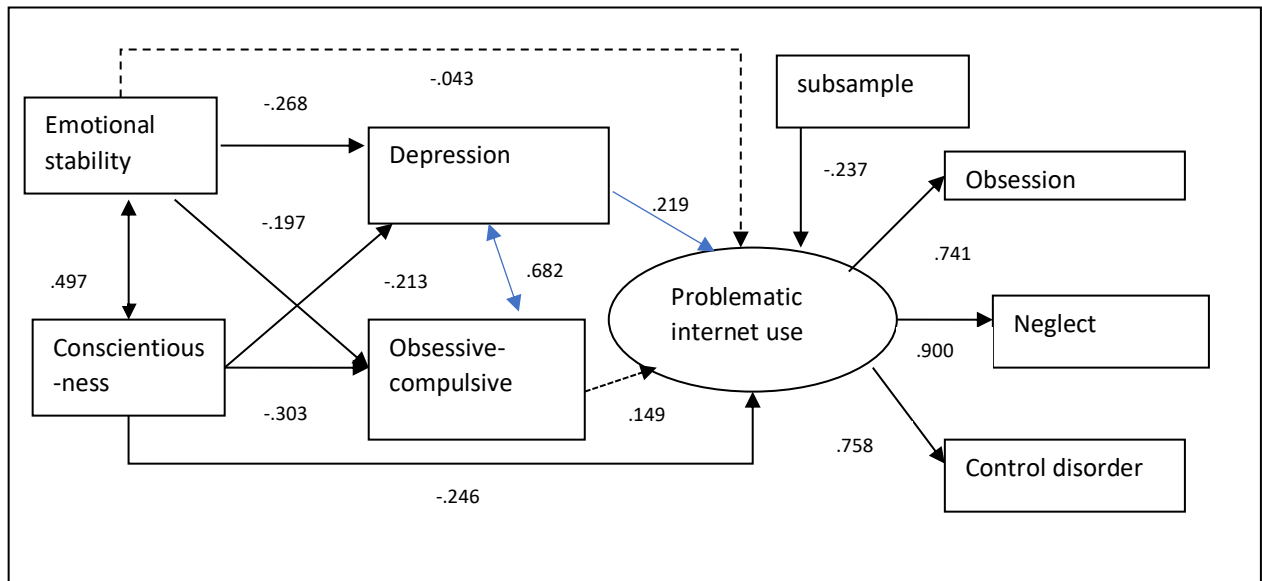
Table 4. Linear regression for prediction of problematic internet use

Independent variable	Standardized $\beta$	R <sup>2</sup>
Sex (0: male, 1: female)	-.013	.239
Subsample (0: clinical, 1: internet café)	-.198 <sup>c</sup>	
BSI Somatization	-.023	
BSI Obsessive-compulsive	.258 <sup>a</sup>	
BSI Interpersonal sensitivity	-.020	
BSI Depression	.362 <sup>b</sup>	
BSI Anxiety	.005	
BSI Hostility	.096	
BSI Phobic anxiety	-.029	
BSI Paranoid ideation	-.130	
BSI Psychoticism	-.087	

*a: P < .05, b: P < .01, c: P < .001*

Based on the preliminary analyses (correlations and linear regression), a model was built to investigate the relationships between problematic internet use, personality traits, and psychopathological symptoms (see Figure 2). It was assumed that depressive and obsessive-compulsive symptoms mediated the relationship between personality traits (emotional stability, conscientiousness) and problematic internet use (the latter defined here as a latent variable). The subsample variable was also added to the model, because there was difference between two subsamples in PIUQ total score. Additionally, after performing linear regression, the subsample variable was significant in predicting the PIUQ score.

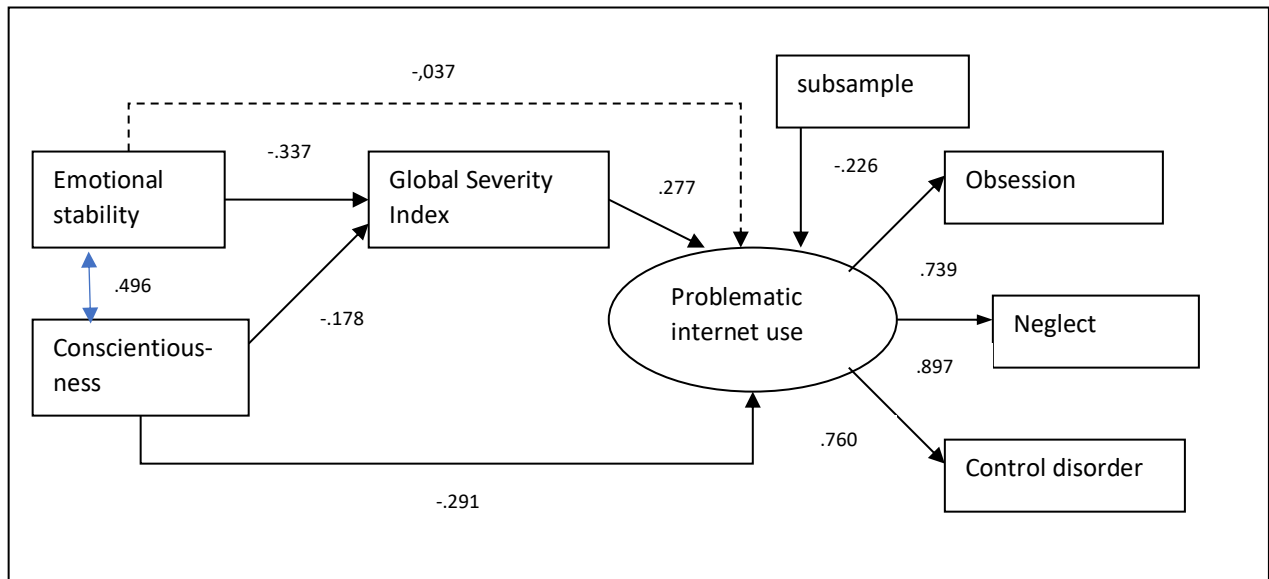
Figure 2. The mediation model and standardized path coefficients



Note: Dashed arrows indicate non-significant path coefficients; continuous arrows indicate significant paths.

The goodness-of-fit indices of the mediation model were appropriate ( $\chi^2 = 14.497$   $df = 14$   $P = 0.28$ ; CFI = 0.995, TLI = 0.991, RMSEA = 0.026 (0.000-0.068), cfit=0.792, SRMR=0.030). Low conscientiousness and depression had direct significant effect on problematic internet use, while, the direct effect of emotional stability and obsessive-compulsive symptoms was non-significant. Both emotional stability and low conscientiousness significantly explained the symptoms of depression and obsession-compulsion. This meant that low conscientiousness directly impacted problematic internet use. However, the indirect effect of low conscientiousness – via depression – was non-significant (standardized indirect effect = -0.047,  $P = 0.109$ ). Emotional stability only affected problematic internet use indirectly, via depressive symptoms (standardized indirect effect = -0.059,  $P = 0.030$ ). The impact of the sample category on problematic internet use was significant. The participants in the clinical sample had higher scores on PIUQ-9 compared to internet café sample. The model explained 32.5% of the total variance of problematic internet use. Given that all the psychopathological symptoms positively correlated with problematic internet use, another mediation model was tested, where, instead of the individual symptoms, the Global Severity Index was used (see Figure 3).

Figure 3. Mediation model with GSI (Global Severity Index)



Note: dashed arrows indicate non-significant path coefficients; continuous arrows indicate significant paths.

The goodness-of-fit indices of second mediation model were good ( $\chi^2 = 16.185$ ,  $df = 11$ ,  $P = 0.13$ ;  $CFI = 0.985$ ,  $TLI = 0.975$ ,  $RMSEA = 0.042$  [0.000-0.083]  $SRMR = 0.030$ ). Low conscientiousness had a direct effect on problematic internet use, while the indirect path via the Global Severity Index was non-significant (standardized indirect effect =  $-0.049$ ,  $P = 0.104$ ). Emotional stability impacted problematic internet use indirectly via the Global Severity Index (standardized indirect effect =  $-0.094$ ,  $p < 0.001$ ), while it had no direct effect on it. The model explained 28.9% of the total variance of problematic internet use.

## DISCUSSION

The results of the present study demonstrated that both samples showed much higher levels of problematic internet use than those observed in normal populations (7.1% in Asia, see: [50]). While this was expected in the clinical sample, the similar prevalence among those recruited from internet cafes was non-evident at the first sight. However, internet cafés have a special position in Chinese internet culture (see: [51-54]). In internet cafés, young people (mostly males, under the age of 30 years) play online games, chat online, and watch movies. It is perhaps not surprising that the prevalence of internet addiction is high among patronage of internet cafés (see: [39, 40, 55]). Furthermore, Griffiths, Kuss, Billieux and Pontes [56] have noted that parents in South East Asian countries appear to pathologize any behavior of their children that takes time away from educational pursuits and the family. This tendency – the parents tend to feel anxious due to their (mainly male) children’s school performance – might lead to be more vigilant for any symptoms of problematic use of internet, and to seek help for their adolescents. However, the psychiatrists interviewed the problematic internet users in this study. This clinical interview regarding the diagnosis for internet addiction is not official and it could have some instability. Furthermore, the currently used scale to assess problematic internet use is not based on official diagnostic criteria. Consequently, there might be a discrepancy in the level of symptoms based on currently used clinical interview and the scale used in the present study (PIUQ).

Based on the outcomes of the preliminary statistical analyses, low conscientiousness and emotional stability negatively correlated with problematic internet use. These findings are congruent with previous results reported in the literature on problematic internet use (e.g., [21,

23, 18, 19, 22, 20]). In their meta-analysis, Kotov et al. [57] found that in the case of adults, high neuroticism (which is equivalent to low emotional stability) and low conscientiousness were also associated with anxiety, depression, and substance use disorders.

Neuroticism was the strongest correlate among the five personality traits, and low conscientiousness was the second trait to have a strong and consistently negative effect size. In another study (i.e., [58]), similar findings were reported. More specifically, extraversion, low conscientiousness, and low emotional stability had the strongest predictive values on psychopathological symptoms. In a large sample of psychosomatic outpatients [59], the level of neuroticism was a differentiating factor between the clinical and non-clinical samples with a large effect size. Additionally, patients with higher neuroticism and low conscientiousness were more likely to have a personality disorder. Therefore, it appears that the importance of these two personality traits is not specific to problematic internet use, but is common in psychopathologies more generally.

The other three personality traits of the Big Five (i.e., agreeableness, openness, and extraversion) did not correlate with problematic internet use in sample of the present study. This result might be explained by the fact that the recruited sample was very specific, including a higher proportion of users with more severe problems. Thus, it is tempting to hypothesize that emotional instability and low conscientiousness might be those personality factors that contribute the maintenance of problematic internet use. However, prospective studies are needed to test this notion. In addition, it is worth noting that the previous correlational findings between problematic internet, openness, and extraversion were mixed, thus further studies are needed utilizing different samples.

Among the psychopathological symptoms, only obsessive-compulsive symptoms and depression were significant predictors of problematic internet use. These findings are in line with previous results (e.g., [8, 1, 14, 12, 13, 4, 5, 15]). In reviewing other addictive behaviors, there are some additional findings that reinforce the results of the present study. For instance, in the case of compulsive buying, Maraz, van den Brink and Demetrovics [60] found an increased level of obsessive-compulsive symptoms among addicted shoppers compared to non-addicted shoppers. Moussas et al. [61] investigated patients of a methadone maintenance treatment program, and depression and obsession-compulsions were found to have the highest mean scores among all the symptoms. Similarly, in the case of methamphetamine users, obsessive-compulsive symptoms and depression were reported to have the highest level among all the psychopathological symptoms, especially for injectors (compared to methamphetamine users who are used other routes of administration) [62]. Based on the aforementioned findings discussed, the association between problematic internet use and specific psychopathological symptoms is similar to the associations between other addictive behaviors and specific psychopathological symptoms (obsessive-compulsive symptoms and/or depression).

On the other hand, the correlational analyses showed that all the psychopathological symptoms correlated with problematic internet use ( $r=0.268-0.404$ ). Additionally, using the Global Severity Index, the mediation model corresponded with the data. In this second model, the path coefficient of GSI to PIU was higher compared to that of the individual symptoms in the first model. Overall, it appears that the level of psychological distress (as indicated by the GSI) is a more important factor regarding problematic internet use than the specificity of psychopathology.

Based on fit indices, both models showed excellent fit to the data. Since the two models were not nested, they could not be compared directly. However, results of the two models appear to be convergent. More specifically, emotional stability only affected problematic internet use indirectly via psychopathological symptoms (regardless of the indices used), while low conscientiousness only had a direct effect on problematic internet use.

The first mediation model examined in the present study was partly in line with previous findings. According to Smits and Boeck [63], the Behavioral Inhibition System relates to neuroticism. Park's et al.'s [37] mediation model, in which BIS impacted internet addiction via depression, reinforces the findings of the model here, where low emotional stability had an indirect effect on problematic internet use. (However, in Park et al.'s model it should also be noted that the direct effect was also significant.) Regarding low conscientiousness, which negatively relates to the BASF (i.e., the fun seeking scale of Behavioral Approach System) [63], Park et al.'s study also found a direct association between BASF and internet addiction, similar to the findings of the present study (between low conscientiousness and problematic internet use). However, in their model, the indirect effect was significant in the case of impulsiveness and anxiety, while the present study did not show any significant indirect effects between conscientiousness, depression, and obsession-compulsion. Based on the outcome of the second path analysis, it could be concluded that low emotional stability only impacts on problematic internet use indirectly (via psychological distress) while low conscientiousness affects problematic internet use directly.

Interpreting the models proposed here, two different types of problematic users might be considered in terms of personality. Problematic internet use has long been known as a heterogeneous phenomenon [64]. Chamberlain, Ioannidis and Grant [65] found that problematic internet use exists with and without other impulsive/compulsive conditions. However, both impair quality of life. It might be assumed that there are different paths leading to problematic internet use depending on the user's personality. One path could be when an individual with high level of neuroticism tries to cope with their negative emotions by repeatedly using the internet more intensively (i.e., compensatory internet use; [66]). In such cases, the level of psychological distress (e.g., depressive feelings) mediates between neuroticism and problematic internet use. Since neuroticism is associated (prospectively) to internalizing symptoms [67], a possible path from neuroticism – via internalizing symptoms (depression and anxiety) – into problematic internet use is likely.

The other path could be when an individual with a low level of conscientiousness becomes vulnerable to problematic internet use. Low conscientiousness is regarded as being disorganized, inefficient, careless, and sloppy because these characteristics equate to a deficit in the executive functions. This could also provide an explanation for the comorbidity with ADHD (e.g., [68-70]). This theory is reinforced by previously reported findings. For example, Van Dijk et al. [71] found that adults with ADHD showed a higher level of neuroticism and a lower level of conscientiousness than healthy controls. Additionally, Gomez and Corr [72] reported in their meta-analysis that inattentive symptoms were associated with low conscientiousness. Regarding internet gaming disorder (IGD), Argyriou et al. [73] also conducted a meta-analysis and demonstrated that there was an association between IGD and impaired response inhibition. They conceptualized IGD as externalizing psychopathology. This is in line with Dong and Potenza's suggestion [74] of a cognitive-behavioral model of internet gaming disorder.

It should also be noted that obsessive-compulsive symptoms were assessed by items such as "trouble remembering things", "difficulty making decisions", and "trouble concentrating". These items might also signal a deficit in the executive functions. However, this subscale was not a significant mediator variable between low conscientiousness and problematic internet use. In future research, it would be worth investigating impulsivity rather than obsession-compulsion in the model such as Park et al.'s [37] or assessing executive functions with cognitive tests (e.g., inhibitory control, decision-making, shifting).

Nevertheless, in the model proposed here, the two paths were not independent from each other. This fact is consistent with other results and theories on different executive functions and the internalizing-externalizing dichotomy. Executive functions may also be divided into hot and

cool components [75], where hot executive functions are involved in highly motivating and emotional situations. Based on this differentiation, neuroticism is associated with the executive function (see: [76, 77]). Additionally, there is evidence that component facets of neuroticism and conscientiousness share a common neurological system, where high neuroticism and low conscientiousness associate with lower scores on the executive function battery [78]. Similarly, internalizing and externalizing disorders are not independent from each other either (e.g., [79]). Additionally, depression is associated not only with neuroticism but also with conscientiousness [80]. Hall, Fong and Epp [81] noted the role of both personality (primary conscientiousness and neuroticism) and executive functions in predicting health behavior patterns, which might underpin the relevance of the model presented here. However, the models only explained 32.5% and 28.9% of the variances of PIUQ. Consequently, further research is needed to identify other important factors shaping the symptoms of problematic internet use. In addition to users' individual personalities, situational, social, and environmental factors would also be worth investigating.

One of the major implications of the findings in the present study is that clinicians should be educated about the possible cultural aspects regarding the associations of personality traits, psychopathological symptoms, and problematic internet use. Additionally, the findings of the present study highlight the possibility of the differences between internet users concerning intensity of usage in the role of personal characteristics in developing problematic internet use.

Finally, it should be noted that the present study has several limitations. First, the sample was non-representative of internet users and included intensive internet users. More representative samples are needed in any replication. The sample was Chinese only and therefore may not be representative of internet users in other countries. Therefore, future research should also include participants of other countries and cultures. The sample size was modest (although adequate for the statistical testing carried out) and future studies should try to recruit as large a sample as possible. It is also suggested that future studies should include samples with a more even distribution of females, because the sample in the present study was predominantly male. Gender differences can then be explored more thoroughly. Finally, the data were self-report and open to well-known biases (including social desirability and poor memory recall). Taking these limitations together, generalization of the findings should be applied with caution. In order to gain reliable data, more objective reports should be added (e.g., family members' and friends' reports on the internet user's behaviors).

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## CONFLICT OF INTERESTS

None declared.

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