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THESES OF THE PHD DISSERTATION

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The measurement of the problematic internet use and its personality psychological characteristics

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1. Introduction and Aims[1]

The popularity and essentiality of internet use is a worldwide and rapidly expanding process. The use of internet not only has made several activities easier and more convenient for us, but also has re-formed our personality and thinking to some extent (Aboujaoude, 2011).

There are several features of internet, which make it uniquely tempting to use (anonimity, interactivity, easy accessibility, no need for physical presence, enjoyment, etc.) (Greenfield, 2011). Some applications of internet which make possibilities for communication, establishment and maintenace of relationships, are so unique that no other technological invention has produced even similar possibilities before (simultaneous communication even with more people or groups), and these features are meeting the biologically and evolutionally pre-set essential needs of people to establish contact with others. Through this runaway process occur, when one person suddenly makes many contacts via internet, but these relationships are not as deep and intensive as the previous relationships which were less in number, but had greater potential carrying capacity (Csányi and Miklósi, 2010). This is defined as the internet paradox by researchers (Kraut et al., 1998).

This way the internet can not only be useful but harmful at the same time for the life of some people. In accordance with the spread of internet use the connected internet use problems have increased also. Since even the internet itself and the problems surrounding it have appeared only a few decades ago, there are still professional disputes about several issues. In accordance with this the American Psychiatric Association has refered the problem as „internet use gaming disorder" into the cathegory of psychiatric problems requiring further research (Grohol, 2012).

Among the main questions of research the first is the problem of measurement of this disorder. This is an important issue both from the clinical and research point of view, although for clinical use the establishment of the diagnostical criteria and for research a well-developed questionnaire is the primary concern. Although since the 1990-es several measurements were used by researchers there is still no measurement which is confirmedly established to be valid (Jia és Jia, 2011).

<u>One of my aims</u> in my dissertation is to develop a possibly well validated and psychometrically confirmed questionnaire measuring problematic internet use which is relatively short at the same time to be easily applicable for clinical and scientific research use.

Furthermore, a relatively less researched field is the detection of the relationship between problematic internet use and different psychological constructs of personality – either from the point of view of psychopathology or normal personality features. These should be studied by applying a complex modell including the interaction of the different constructs. In accordance with this, my <u>second aim</u> is to develop a mediation model concerning the psychological constructs connected to problematic internet use – self-esteem, anxiety, depression, self-satisfaction with physical appearance, psychopathological symptoms, personality traits – and based on these, to be able to draw some conclusions concerning the etiology of problematic internet use.

2. Theoretical background

[1] I would like to thank my thesis advisor, Dr. Zsolt Demetrovics, for my guiding and supporting me during 10 years, and also thank Dr. Gyöngyi Kökönyei for her help in the statistical analysis.

2.1. Definition

One of the two most frequently used defining approach use the addictological theoretical frame, defining internet addiction as a behavioral addiction or - since behavioral addiction is not included in the international nosological systems – as an impulse-controll disorder (Young, 1998a; Griffiths, 1998; Shapira et al., 2003). The other approach uses a cognitive-behavioral modell, which emphasize the pathological cognitive and behavioral features of problematic internet use (Caplan, 2002).

There is no consensus weather problematic internet use should be considered a separately defined disorder or as a group of symptoms covering other underlying disorders (eg.: anxiety, depression).

2. 2. Measurements

There were several measuring devices constructed in the past few years concerning internet addiction or problematic internet use, some of these aimed to identify the components of problematic internet use (Chou, Condron and Belland, 2005; Beard, 2005; Jia and Jia, 2009, 2011).

The two earliest and most frequently used measurement in international research is connected to Young (1998a, 1998b). The 8 items Diagnostic Questionnaire consists of yes-or-no questions, while the 20 items Internet Addiction Test/Scale, IAT/IAS works with a 5-point Likert Scale. There were several researches aiming to validate and to identify the subfactors of IAS, but the results were very heterogeneous. Widyanto and McMurran (2004) has verified six factors (salience, excessive use, neglecting work, anticipation, lack of control and neglecting social life). Chang and Law (2008) have found three factors (withdrawal and social problems, time-management and performance, reality substitute). Widyanto, Griffiths and Brundsden (2011) have also arrived to a three factors structure: emotional/psychological conflict, time management issues, and mood modification. Other studies have recommended one factor (pl. Khazaal et al., 2008) or two (Barke, Nyenhuis, Kröner-Herwig, 2012) or five factors (Chong Guan et al., 2012). Most of the studies were concluded on not representative samples and there is difference concerning the age and the cultural background of the researched samples.

The Generalized Problematic Internet Use questionnaire of Caplan (2002) and the Online Cognition Scale of Davis, Flett and Besser (2002) are theory-driven measurements: they were developed using the cognitive-behavioral model of pathological internet use. On the other hand in spite of the fact that these are among the psychometrically better established measurements these were used only in few studies.

The Compulsive Internet Use Scale of Meerkerk et al (2009) is used in more researches nowadays, which is a psychometrically well established, one-factor questionnaire.

2.3. Epidemiology

Concerning the prevalence of internet addiction very divergent data were found depending on where, how, when, and on what kind of sample was the study performed, and what method, what kind of measurement and which criteria were used by the researchers to establish problematic internet use. The smallest prevalence value was 0,3-0,7%, which was obtained in the USA among adult population (Aboujaoude, Koran, Gamel, Large, Serpe, 2006). In a representative sample of Norvegian adolescents 1,98% prevalence was found (Johansson és Götestam, 2004). The highest values were obtained in Asia, where even values above 10% were obtained (Yang and Tung, 2006; Mythilly, Qiu and Winslow, 2008; Kim et al, 2010).

A larger portion of the studies showed that most of the problematic internet users are males (Morahan-Martin and Schumacher, 2000; Ritter et al, 2004; Yang and Tung, 2007;

Siomos et al, 2008; Canbaz, Sunter, Peksen, Canbaz, 2009; Korkeila, Kaarlas, Jaaskelainen, Vahlberg, Taiminen, 2010; Tsitsika et al, 2011). On the other hand Young (1998a, 1998b) drew attention to the vulnerability of women. A fresh study incorporating a representative sample of adolescents thoughout whole Europe (Durkee et al, 2012) found higher proportion of boys among pathological internet users, while in the milder, but also problematic (maladaptive use) category the girls were overrepresented. On the other hand this can differ in different countries as well, since in Estonia and Slovenia maladaptive use is more frequent among boys.

There is gender difference not only in problematic use, but in the type of activities they use the internet for. One of the differences is for example, that women more frequently use internet for social purposes (public sites, chat-rooms), while men rather use it for play, video watching and reading of news (Durkee et al, 2012; Ak, Koruklu, Yilmaz, 2012).

In the literature many populations were described who are more vulnerable than average for problematic internet use. The adolescent age-group is increasingly affected by internet addiction partly because of the age-specific features, partly because of the school-attending lifestyle (internet use is widespread in learning, teaching, and in colleges). The latter cause is also relevant in the case of young adult university students who study far away from parental control and their previous social network (Kandell, 1998).

Not all youngsters are equally vulnerable from the point of view of problematic internet use. Many researches have studied those risk factors which play a role in internet addiction. Among these risk factors are: living together with not biological parents or other relatives, or the percieved lack of parental support, permanent partner-relationship, or if the parent or caregiver is unemployed (Durkee et al, 2012). Also risk factor the divorce of parents, or disfunctional family relationships (Tsitsika et al, 2011), the lack of family-control, family conflicts (Yen et al., 2009a). Jang and Ji (2012) in their study verified the direct and indirect effects of parental problem-drinking to problematic internet use among young-age adolescent boys and girls. Migration also increases the risk of both depression and problematic internet use for children and adolescents (Guo et al, 2012). Opposed to these the appropriate secure attachment between parents and adolescents plays a preventive role in the development of internet addiction (Siomos et al., 2012).

2.4. Comorbidity

The comorbidity of internet addiction with other psychiatric sympoms or states was studied on both clinical and non-clinical samples. The most frequent clinical disorders among patients diagnosed with internet addiction are depression and other affect/mood disorders, and anxiety disorders (eg. social phobia, generalised anxiety) (Shapira, Goldsmith, Keck, Khosla and McElroy, 2000; Ko, Yen, Chen, Chen and Yen, 2008; Bernardi and Pallanti, 2009, Tsitsika et al., 2011). At the same time both depression and the amount of anxiety correlates with the severity of internet addiction in non-clinical samples as well (pl. Young and Rodgers, 1998a; Nyikos et al., 2001; Kim et al., 2006; Ha et al., 2007; Yen et al., 2008; Park et al., 2012).

Internet addiction and obsessive-compulsive symptoms, and psychoactive substance dependence, or legal and illegal substance use are closely connected (Shapira et al., 2000; Ko et al., 2006; Ha et al., 2007; Jang et al., 2008; Bernardi and Pallanti, 2009).

Among people diagnostized with internet addiction eating disorders and different personality disorders (eg.: borderline, avoidant, compulsive) are also common (Shapira et al, 2000; Bernardi and Pallanti, 2009; Tao and Liu, 2009).

It was proven both with children, adolescents and university students that internet addiction and the severity of ADHD symptoms are related (Yoo et al, 2004; Ko et al, 2008; Cao et al, 2007; Yen et al; 2009b).

Ko et al. (2009) in a two year long prospective longitudinal study including 1848 adolescents (age mean: 12,36 years) found that depression, ADHD, social phobia and hostility were risk factors for the appearance of internet addiction. The most significant predictors were ADHD and hostility. Depression and social phobia were good predictors only in the case of females.

2.4. Etiology

From the several studies primarily I quote here those that are most relevant from personality psychological and psychopathological point of view.

One of the most frequently studied psychological disorder concerning internet addiction is depression, which shows a definite connection with it (Young, Rodgers, 1998a; LaRose et al, 2001; Caplan, 2002; Kim et al, 2006; Yang, Tung, 2007; Mythily et al, 2008; Lin, Ko and Wu, 2011; Park et al, 2012). At the same time the establishment of causal relationship is hard, therefore it is equally reasonable to hypothetise that (1) mood problems appear as the result of problematic internet use, or (2) people turn towards internet on the ground of depressive symptoms, which helps compensating for depressive symptoms, avert their thoughts from the problems, or the social support acquired from internet and positive experience, etc. helps decreasing depression. Most probably the correct conclusion is to consider the interaction of the two processes, meaning that the original mood problems contribute to the onset of increased internet use, which in turn further worsens the magnitude of mood symptoms (Park et al., 2012).

Many researchers confirmed that lonely persons are more susceptible to internet addiction (Young and Rodgers, 1998b; Morahan-Martin and Schumacher, 2000; Caplan, 2002; Whang et al., 2003). There is also a connection between problematic internet use and lower self-esteem (Armstrong, Philips and Saling, 2000; Caplan, 2002; Niemz, Griffiths, Banyard, 2005; Yang, Tung, 2007; De Berardis et al., 2009). Both in the case of loneliness and self-esteem – similarly to depression – the assumption of mutual causal relationship is the most probable.

There were a few longitudinal studies aiming to reveal causal relationships. Kraut et al. (1998) followed 169 persons from the point of introducing internet into their homes through one-two years measuring the effects on family communication, psychological well-being and on other social relationships. Their results showed that the greater internet use was associated with a decrease in family communication and a decreasing magnitude of their social network, and with an increase in depression and lonelyness. They defined the *internet paradox* thesis, meaning that although internet is used for communication in the first place, the excessive use of internet is rather associated with a decrease in social involvement and psychological well-being. An explanation can be that people substitute their stronger, real relationships with new lower quality internet-relations, which cannot be embedded in their former relationship network. But these negative effects of internet use disappeared towards the end of the third year (Kraut, Kiesler, Cummings, Helgeson, Crawford, 2002).

Taking into consideration that one of the possible explanatory frames is derived from the relation of internet addiction and impulse control problems, there emerge the question of possible connection between impulsivity, disinhibition, sensation seeking and problematic internet use. Most of the studies verified this connection in the cases of social disinhibition (Morahan-Martin and Schumacher, 2000; Niemz et al., 2005), sensation seeking (Lin and Tsai, 2002), impulsivity (Cao et al., 2007; De Berardis et al., 2008; Mottram and Fleming, 2009; Lin, Ko and Wu, 2011), and decreased self-controll (Kim et al., 2008). On the other hand the results concerning sensation seeking are not unequivocal (eg. Armstrong et al., 2000).

The connection between *temperament characteristics* and problematic internet use still needs to be investigated. Internet addiction on the one hand is associated with high novelty seeking, high harm avoidance and lower reward-dependence (Ko et al., 2006, 2010; Dalbudak et al., 2013), on the other hand in another research (Cho et al., 2008) higher self-directedness and cooperativeness, and lower novelty seeking and self-transcendence.

The relationship of internet addiction and psychopathological symptoms was investigated in several studies. Two types of samples were used: 1. Non-clinical sample (Yang et al., 2005; Jang, Hwang and Choi, 2008; Alavi et al., 2012), 2. among diagnosed internet addicts (Huang et al., 2010; Tonioni et al., 2012). All the researches agreed in that problematic internet use and the amount of depressive symptoms is interconnected. Most of the researches (Yang et al., 2005; Jang, Hwang and Choi, 2008; Huang et al., 2010) found a connection between internet addiction and the amount of obsessive-compulsive symptoms. Two studies (Yang et al., 2005; Huang et al., 2010) found that problematic internet users show higher amount of hostility and more paranoid ideation. The surveys performed on the two clinical samples agreed in that the extent of anxiety symptoms is also connected to internet addiction. One Iranian research (Alavi et al., 2012) has proved increase in all the psychopathological symptoms among problematic internet users.

There is only one longitudinal study concerning the study of the relationship between psychopathological symptoms and problematic internet use (Dong, Zhou and Zhao, 2011a). The results showed that the obsessive-compulsive symptoms were present already before the development of addiction. One year later the obsessive-compulsive symptoms, depression, anxiety symptoms and hostility were significantly higher among internet addicts compared to normative values. Considering the one year earlier values of addict people changes occured in *depression, anxiety, hostility, interpersonal sensitivity, and psychoticism.* Based on this it can be hypothesized that these latter symptoms are the consequences of internet addiction, while the obsessive-compulsive symptoms are the predictors of the development of internet addiction.

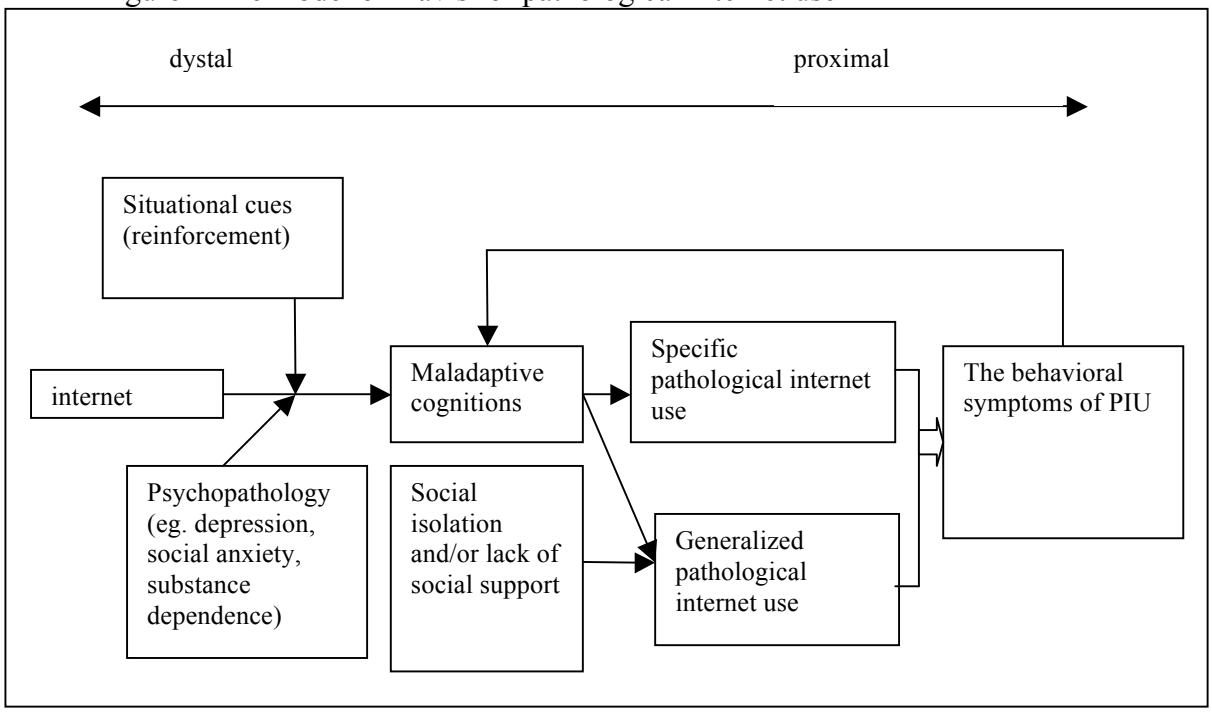
In most of the studies dealing with the relationship between *personality traits* and problematic internet use (Cao and Su, 2007; Tosun and Lajunen, 2009; Huang et al, 2010) there was a connection between the Eysenck's *psychoticism* and problematic internet use. Two researches (Cao and Su, 2007; Tsai et al., 2009) found connection between *neuroticism* and problematic internet use, while Huang et al. (2010) found internet addict adolescents to be more *introverted*. Wilson, Fornasier and White (2010) had different results. The cause for this difference might be that they studied exclusively the SNS (MySpace, Facebook) use of youngsters. They found that *extroverted and less conscientious* persons reported more intense SNS use and addictive tendencies.

In the second part of the last decade more and more researches try to place problematic internet use into a wider theoretic framework, or try to apply a more complex approach opposed to the fewer aspects of previous studies. One of these wider theoretical frames is the learning-theoretical perspective.

Davis (2001) was the first among the researchers to propose a cognitive-behavioral theoretical frame to understand pathological internet use. As a distant, but essential cause of pathological internet use he presumes the presence of a previous psychopathology in the user. Adding to this a stressor (eg. introduction to internet or a new application) and in the sence of the diathesis-stress modell the problematic internet use is activated. Internet, the new possibilities and the experience with it can catalyze the development of pathological internet use. During use other circumstances which are connected to the use of internet (e.g. the tactile feeling of the claviature during typing) can become secondary reinforcements. Close contributory factors can be the cognitive disfunctions of the person, such as „I am only good on the internet" or „I am worthless offline, but online I am someone".

The lack of social support of family or friends and/or social isolation can increase the generalised pathological internet use. The internet-friends can push to the background the non-internet relationships and the person may become even more isolated.

Figure 1 The model of Davis for pathological internet use



Caplan (2002) had made his research using this theoretical frame. According to his results, pathological internet use is closely connected to depression, problems with self-esteem, loneliness, and shyness. Among the maladaptive cognitions of pathological internet use, the health variables were most influenced by the percieved social benefits (meaning the *preference for online social interaction*). Caplan had interpreted the results as social isolation has an outstanding role. Those people, who are lonely and prefer the online social interactions to face-to-face communication were more likely to have more severe behavioral problems due to internet use. In his next study Caplan (2005) proposed a modell stating that the social skills deficit make people more susceptible to prefer online social interactions to face-to-face interactions. At the same time, the deficit in social skills is concomitant with other psychosocial problems (depression, lonelyness, social anxiety). Between these problems and the negative consequences of internet use the preference of online social interactions seems to be the mediating factor. Caplan measured the ability of social control as social skill. The ability of social control means the capacity of self-presentation, management of impression making. The deficits of these skills may lead a person to try the virtual space, since the online communication partners can more easily choose from self-representational strategies, thus they can make a more idealised impression, and as a consequence more intimate interaction can develop between the partners than in face-to-face situations.

Shepherd and Edelmann (2005) have also found the deficit of social skills int he background of turning towards online communication. They identified increased internet use as a possibility for the regulation of social anxiety. The results of Iacovelli and Valenti (2009) have confirmed that in an interaction others find the excessive internet users less likeable because of their underdeveloped social skills. The experimental results of Rice and Markey (2009) had shown that people with higher scores of introversion or neuroticity had felt

stronger anxiety in a face-to-face interaction than in a computer-mediated communication situation.

The constructs closely connected to the theme of social skills problems are *emotional intelligence and alexithymia.* The positive predictor or mediating relationship of these constructs to internet addiction was proven by several authors (Parker et al., 2008; Beranuy, Oberst, Carbonell and Chamarro, 2009; De Berardis et al., 2009)

3. The empirical studies

3.1. First study: The development of the Problematic Internet Use Questionnaire

3.1.1. Participants

A total of 1,064 participants completed the questionnaires, of which 27 questionnaires had to be dropped due to inconsistencies or lack of relevant answers. According to the analyzed 1,037 questionnaires, 54.1% of the participants were males. The mean age was 23.3 years (*SD* = 9.1).

3.1.2. Measures

Problems related to Internet use. In a previous study (Nyikos, Szeredi, & Demetrovics, 2001), a questionnaire of 30 items was constructed to measure problematic Internet use (the *Internet Addiction Questionnaire*). The questionnaire partly consisted of the items on Young's (1998a) Internet Addiction Test (IAT) or their modifications (first 20 items). Additional items were constructed by considering symptoms described in the literature of problematic Internet use. For every question of the IAT, participants had to estimate how much the given statement was true for them on a scale between 1 (*never*) and 5 (*always*).

3.1.3. Results and discussion

A factor analysis with varimax rotation was made for the 30 items. The analysis resulted in a four- and a three-factor solution. In the former solution, the first three factors corresponded to the factors of the three-factor solution, but there was an additional fourth factor consisting of only 3 items. Since all these items had a high weight in one of the first three factors, we decided to use the three-factor solution. These three factors explained 41.96% of the variance.

The first factor included 11 items. The substance of these items was, on the one hand, *mental engagement with the Internet*—that is, daydreaming, fantasizing a lot about the Internet, waiting for the next time to get online—and, on the other hand, *anxiety, worry, and depression caused by lack of Internet use*. This factor was called the *obsession* scale.

The second factor included 10 items. The substance of these items was *neglect* of everyday activities and essential needs. Items about the decreasing importance of household chores, work, studies, eating, partner relations, and other activities and the neglect of these activities due to an increased amount of Internet use were included. Thus, this factor was named the *neglect* scale.

The third factor included eight items. These items referred to *difficulties in controlling Internet use*. They expressed the fact that the person used the Internet more often and/or for a longer time than had previously been planned and that, despite his or her plans, he or she was not able to decrease the amount of Internet use. Items also referred to perceiving Internet use as a problem. This factor was named the *control disorder* scale.

Subsequently, each item was reviewed on the basis of its weight within the scale, its corrected item–total correlation value, and its meaning in order to reduce scales and create a clear-cut factor structure. The frequency of not getting answers to the items from the

participants was also considered. As a result of this reduction, three subscales were created, each containing six items (see Table 1).

Table 1 Factor structure of 18-item-long PIUQ

	Factor I: Obsession	***Factor II: Neglect***	***Factor III: Control Disorder***
4. How often do you daydream about the Internet?	**0.789**		
1. How often do you fantasize about the Internet, or think about what it would be like to be online when you are not on the Internet?	**0.752**		
7. How often do you feel tense, irritated, or stressed if you cannot use the Internet for as long as you want to?	**0.693**		
10. How often do you feel tense, irritated, or stressed if you cannot use the Internet for several days?	**0.669**	0.321	
13. How often does it happen to you that you feel depressed, moody, or nervous when you are not on the Internet and these feelings stop once you are back online?	**0.633**		
16. How often do you dream about the Internet?	**0.630**		
2. How often do you neglect household chores to spend more time online?		**0.733**	
5. How often do you spend time online when you'd rather sleep?		**0.624**	
8. How often do you choose the Internet rather than being with your partner?		**0.572**	
11. How often does the use of Internet impair your work or your efficacy?		**0.531**	0.327
14. How often do people in your life complain about spending too much time online?		**0.528**	
17. How often do you choose the Internet rather than going out with somebody?		**0.457**	
3. How often do you feel that you should decrease the amount of time spent online?			**0.760**
6. How often does it happen to you that you wish to decrease the amount of time spent online but you do not succeed?			**0.720**
9. How often do you try to conceal the amount of time spent online?			**0.645**
12. How often do you feel that your Internet usage causes problems for you?			**0.602**
15. How often do you realize saying when you are online, 'just a couple of more minutes and I will stop'?			**0.488**
18. How often do you think that you should ask for help in relation to your Internet use?			**0.461**

Test–retest reliability of the scales was checked by Pearson correlation. Sixty-three university students participated in the study, who filled out the questionnaire again after 3 weeks. The data were collected in groups after a university lecture. For the main scale, the correlation of pre–post data collections was high (.903; p <.0001). The correlations of the subscales were found to be between .763 and .904 (p <.0001 in all cases).

Regarding its psychometric features and its contents, the PIUQ proved to be a useful assessment tool for measuring problems in connection with Internet use. Since the full scale and the subscales have a high inner consistency and the PIUQ has a favorable test–retest reliability and a coherence in its conception and contents, the further use of this questionnaire seems to be reasonable. The resulting three-factor model reflects the results of the analysis of

the original IAT questionnaire (Widyanto & McMurran, 2004) and indicates that the modification of the questionnaire was indeed needed. In the PIUQ, 11 (modified or unaltered) items of the original IAT scale were kept, and an additional 7 new items were added to the questionnaire of Young (1998a). As a result, PIUQ has a more compact, more tense factor structure and does not include less substantial factors with 2 or 3 items (IAT has four factors like that out of six) that would be difficult to interpret as a scale. Of the four factors reflecting cognitive processes more than behaviors that were described by Davis et al. (2002), impulse control disorder and, partly, the factor of distraction were reproduced in the PIUQ model. Presumably, dissenting conceptions are responsible for the differences. Although different studies have resulted in slightly different factor structures (see, e.g., Caplan, 2002; Pratarelli & Browne, 2002), observations support the multifactor model of Internet addiction, and not the one-factor model of Nichols and Nicki (2004).

It seems that interpretation of the phenomenon of problematic Internet use in a behavioral addiction frame could be a reasonable approach. There are major symptoms — such as *control disorder* (PIUQ, third factor), which is an unconquerable desire to engage in a given conduct, and, in connection with this, *engagement in thoughts* (first factor), the appearance of withdrawal symptoms (especially in cases in which implementing an action is prevented), and probably the most significant sign of problems, *neglect* of life areas that were previously considered to be important—that are shared characteristics of all chemical and behavioral addictions, including Internet addiction.

3.2. Second study: Confirmation of the three-factor model of Problematic Internet Use Questionnaire on off-line adolescent sample

3.2.1. Objective of the study

Our objective was to test whether the PIUQ keeps its ideal psychometrical indices in cases of different types of data collection methods and different age groups. Therefore, first we analyzed the psychometric properties of the PIUQ on off-line samples of adolescents.

3.2.2. Participants

Eight general high schools were invited to participate in the study. Schools were selected to represent a wide variety of high schools in terms of location and socioeconomic characteristics of their neighborhood. For each high school, one second- and one third-year class were randomly selected.

Of the 457 students who answered the questionnaire, data for 19 participants were dropped because of the high number of missing values. The final sample was composed of 438 high-school students (195 boys and 243 girls). The mean age of the students was 16.02 years (standard deviation [SD] = 0.69 years, age range: 15–17). The higher proportion of girls in this sample was in accordance with gender distribution in general high schools in Hungary.

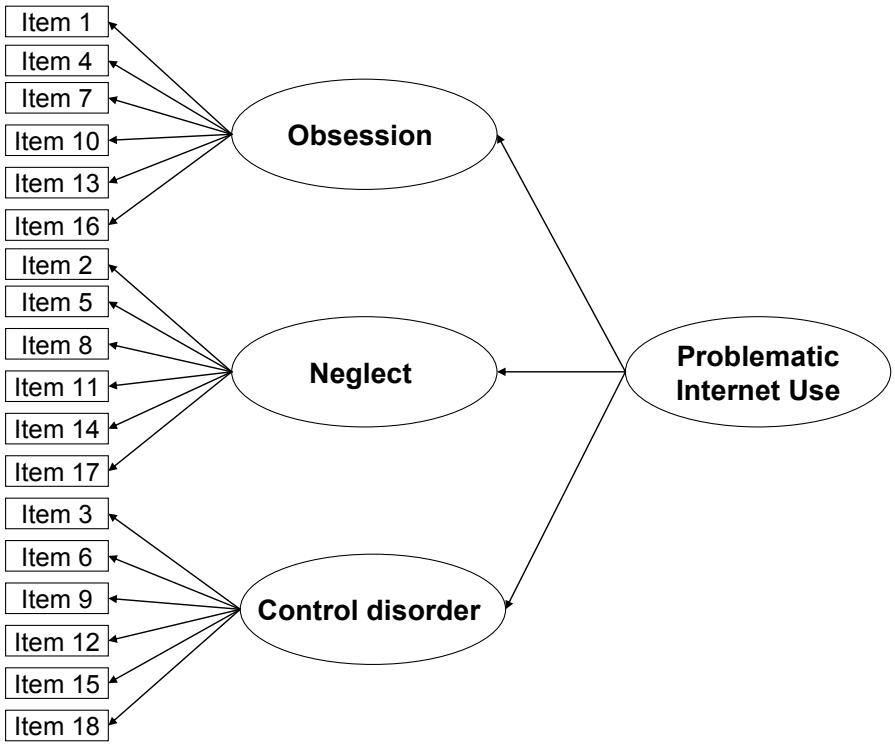
3.2.3. Measures

Problematic Internet use was measured by the threefactor PIUQ.

3.2.4. Results and discussion

SPSS 16.0 and Mplus 6.0 were used for statistical analyses. We applied a confirmatory factor analysis framework to confirm the measurement model of problematic Internet use. We compared two nested measurement models, namely one-factor and the originally proposed three-factor structure with one second-order factor (Fig. 2). We included the one-factor solution here because high correlations (0.468–0.513) among the three subscales were found.

Fig. 2 Three-factor model of problematic Internet use



Fit indices of single-factor and three-factor solutions are presented in Table 2. The other fit indices of the one-factor solution reveal less or marginally adequate fit to the data. However, the fit indices of the three-factor solution indicate a good fit. Statistical comparison of the two nested models with $\chi 2$ difference test revealed that the three-factor solution has significantly closer fit to the data than the one-factor solution in adolescents ($\chi 2$ different test = 92.2, df = 3, $p < 0.001$). Therefore, the threefactor solution more closely represents the data covariance matrix than the one-factor solution.

Table 2. Fit indices of the confirmatory factor analysis testing the one- and three-factor models

	One factor	3 factors
X^2	516,6	396,5
Df	135	132
TLI	0,931	0,951
CFI	0,939	0,958
RMSEA	0,080	0,068

We constructed the brief version of PIUQ with the inspection of the item-to-total correlations for the three subscales of the PIUQ. We also separately performed one-factor exploratory factor analyses for each subscale to obtain factor loadings. Three items per subscale were selected to achieve high item-to-total correlations and factor loadings while maintaining construct content coverage. In the brief version, obsession subscale consists of items 7, 10, and 13, neglect subscale consists of items 2, 5, and 14, and control disorder subscale contains items 3, 6, and 9. Chronbach's alpha of the full brief scale is 0.87 in the adolescent sample.

Confirmatory factor analysis conducted on adolescent sample and online data collection methods undoubtedly supported the original three-factor model of the PIUQ against the other possible one-factor solution. In the case of the three-factor model, all indices were satisfactory in the sample of adolescents interviewed in groups.

3.3. Third study: Confirmation of the three-factor model of Problematic Internet Use Questionnaire on off-line adult sample

3.3.1. Objective of study

To continue the process of validation on adult, representative sample.

3.3.2. Participants

The target population of the survey was the total population of Hungary between 18 and 64 years of age (6,703,854 persons). The net sample size was 2,710 (response rate: 85.1 percent). A total of 1,023 persons (37.7 percent)—those who reported weekly or more frequent Internet use—were asked to fill out an additional questionnaire regarding their Internet use and 963 (94.1 percent) agreed to answer these questions. The mean age of the respondents was 33.6 years (SD = 11.8 years, age range: 18–64) and 49.9 percent of the sample were males.

3.3.3. Measures

Problematic internet use was measured by the threefactor PIUQ.

3.3.4. Results and discussion

Fit indices of single-factor and three-factor solutions are presented in Table 3. The other fit indices of the one-factor solution reveal less or marginally adequate fit to the data. However, the fit indices of the three-factor solution indicate a good fit. Statistical comparison of the two nested models with $\chi 2$ difference test revealed that the three-factor solution has significantly closer fit to the data than the one-factor solution in adolescents ($\chi 2$ different test = 123.9, df = 3, $p < 0.001$). Therefore, the threefactor solution more closely represents the data covariance matrix than the one-factor solution.

Table 3. Fit indices of the confirmatory factor analysis testing the one- and three-factor models

	1 factor	3 factors
X^2	819,4	663,0
Df	135	132
TLI	0,944	0,956
CFI	0,951	0,962
RMSEA	0,072	0,065

Confirmatory factor analysis conducted on the adult sample also supported the original three-factor model of the PIUQ against the other possible one-factor solution. In the case of the three-factor model, all indices were satisfactory inboth the sample of adolescents interviewed in groups and the sample of adults interviewed individually. Therefore, we could cross-validate the measurement model of PIUQ on two independent samples.

3.4. Fourth study: The cultural validation of PIUQ on a sample of Chinese university students

3.4.1. Objective of study

To investigate whether our questionnaire is working in a different, not Western culture.

3.4.2. Participants

Participants were from four universities in Beijing. The study consists of self-administrative, paper-pencil questionnaires. 807 students administered the questionnaires. We excluded 39 persons because of the high number of missing values. The final sample was 768 students (542 females, 226 males). The mean age was 20.6 years (SD = 1.56), the proportion of males was 29.4%.

3.4.3. Measues

Problematic Internet Use Questionnaire Short Form (PIUQ-SF) We used the Mandarin translation of PIUQ. The staff of the Institute of Psychology of Chinese Academy of Sciences (Beijing) helped us translating our questionnaire to Mandarin.

Chinese Internet Addiction Inventory (CIAI) (Huang et al., 2007) was used to assess concurrent validity. The authors developed the questionnaire on a sample of Chinese university students. From the original 42 items, 31 items compose 3 factors: Mood modification (related to mood modification, escaping coping style), Dependence (related to tolerance, preoccupation, withdrawal symptoms), and Conflicts (related to negative consequences, salience, relapse). The respondent has to estimate how much the given statement is true for him/her on a Likert scale between 1 and 5. The internal consistency of subscales and the total scale was excellent (Cronbach-alpha was 0.91 for Conflicts, 0.79 for Mood Modification, 0.81 for Dependence, and 0.93 for the Total scale).

3.4.4. Results and discussion

For Problematic Internet Use Questionnaire Short Form we applied a confirmatory factor analysis (CFA) to confirm the three-factor model of the PIUQ. This model provided a good fit to the data, after freeing the error covariance between the item 6 and item 9($\chi 2$=118.5 df=23 $p<0.001$; CFI=0.946; TLI=0.915; RMSEA= 0.074 [0.061-0.087]; SRMR=0.060).

The correlation of subscales of PIUQ and the subscales of CIAI is shown in Table 4.

Table 4 The correlation of scales of PIUQ and the subscales of CIAI

	Obs.	Negl.	Contr.	PIUQ	Confl.	Moodm.	Dep.
Obsession							
Neglect	0,519						
Control Disorder	0,489	0,649					
PIUQ-9	0,795	0,854	0,863				
Conflicts	0,678	0,702	0,658	0,806			
Mood modification	0,441	0,482	0,445	0,545	0,494		
Dependence	0,624	0,610	0,596	0,727	0,757	0,617	
CIAI	0,691	0,709	0,671	0,822	0,925	0,743	0,902

The confirmatory factor analysis supported the three factor structure of PIUQ Short Form. The internal consistency of PIUQ-9 was good, just the Neglect subscale had less

reliability (0.607). The cause can be that the most of Chinese students lived in dormitory in Beijing, so the context of two items of 3 was much different than in case of the students who lived at home (related to neglect household chores or the complaining of people about the spending online time of the student).

In the concurrent validity we found that CIAI highly correlated with PIUQ. The subscales of CIAI measure other aspects of problematic internet use than the subscales of PIUQ, but the correlation between the subscales of both measurements was relatively high.

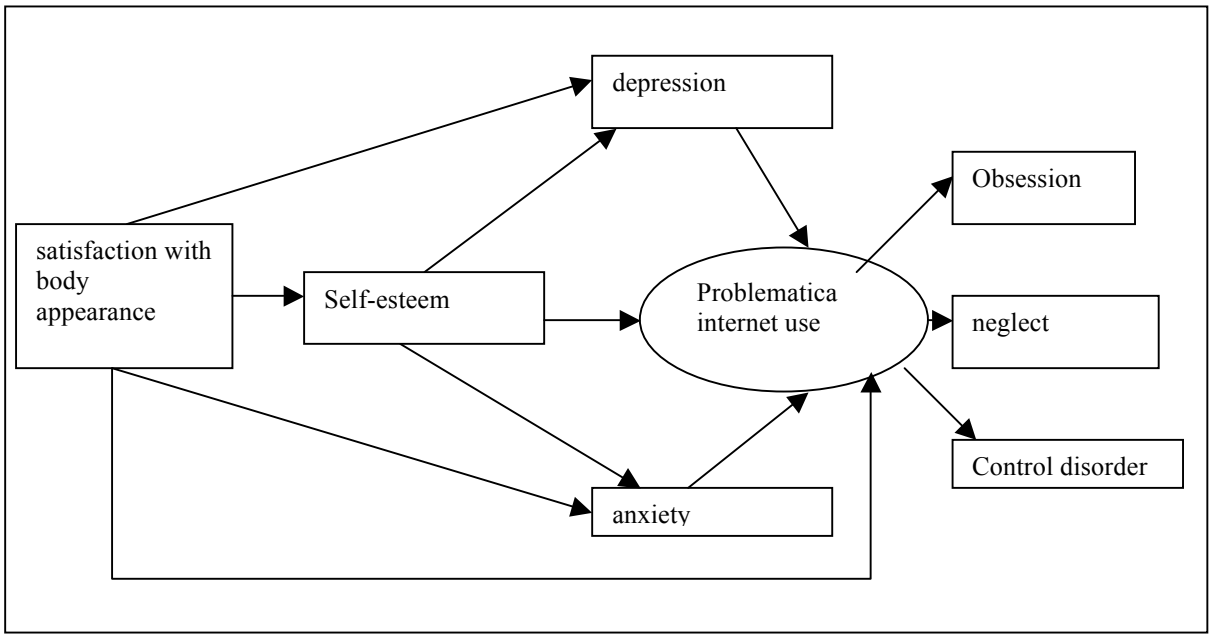
3.5. The fifth study: The mediation role of self-esteem, depression and anxiety between satisfaction with body appearance and problematic internet use

3.5.1. Objective of the study

The role of the *satisfaction with physical appearance* was investigated; however only few studies have identified concern about *body image/body image avoidance* as a predictor of problematic internet use (Hetzel-Riggin és Pritchard, 2011; Rodgers és mtsai, 2013). The low number of studies on the topic is even more surprising given that one of the main attractions of internet is the lack of physical presence that provides a communication medium for hiding actual and perceived physical disabilities. Nevertheless, the negative impact of dissatisfaction with physical appearance on self-esteem has been reported in several studies (Young, 1998b; Griffiths, 2000).

We suggest a more complex model that provides the possibility to study all relationships within a common framework (rather than the more simplistic association analyses reported in previous studies). The proposed model not only integrates factors studied in previous studies (i.e., depression, anxiety, self-esteem) but also includes body image satisfaction. That means that the internet user who is dissatisfied with his/her appearance experiences more anxiety and depression symptoms as well as shows more problematic internet use. Thus it was hypothesized that dissatisfaction with bodily appearance would be associated with depression, anxiety symptoms and self-esteem (see Figure 3). It was also hypothesized that satisfaction with body image has both direct and indirect (through the mediating effect of depression and anxiety) effects on problematic internet use. It was also hypothesized that the proposed mediation model would be invariant across both sexes.

Figure 3 The hypothetical model for mediation role of depression, self-esteem, anxiety between body image satisfaction and problematic internet use



3.5.2. Participants

A total of 694 participants (58.5% male) completed an online questionnaire (34 participants were excluded due to inconsistencies or a high proportion of missing data). The mean age was 21.5 years (sd=5.2) with all participants aged between 14 and 34 years.

3.5.3. Measures

Problematic internet use was measured using Problematic Internet Use Questionnaire (PIUQ). *Self-esteem* was assessed using the Hungarian version of Rosenberg's Self-Esteem Scale (RSES-HU) (Rosenberg, 1965). This scale contains five positively and five negatively worded items and is answered on a 4-point Likert-scale. This construct of global self-esteem measured by the RSES-HU has recently been confirmed in Hungarian population (Urban és mtsai, 2012).

Anxiety was assessed using the State-Trait Anxiety Inventory (STAI) (Spielberger, Gorsuch, & Lushene, 1970; Sipos, Sipos, Spielberger, 1988).

Depression was assessed using the Center for Epidemiological Studies Depression Scale (CES-D) (Radloff, 1977).

Satisfaction with body appearance was assessed using an 8-item questionnaire designed by the author. The items relating to body appearance were answered on a 5-point Likert scale contain statements concerning satisfaction and dissatisfaction with physical appearance. The items showed high internal consistency (Cronbach's alpha = 0.809).

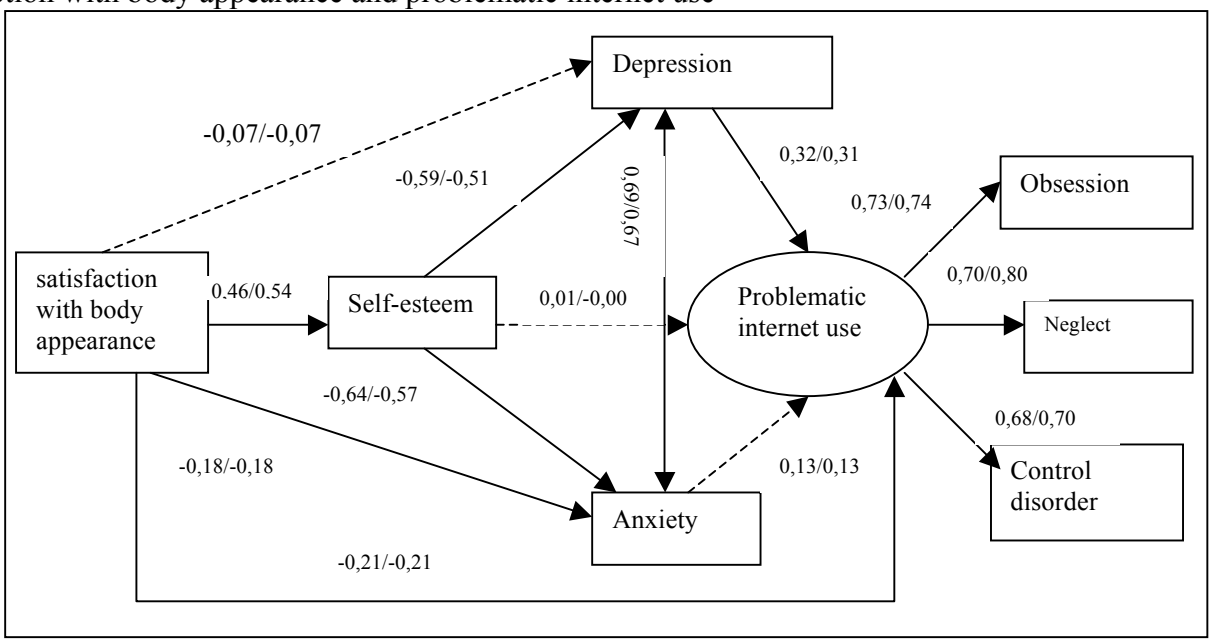
3.5.4. Results and discussion

The proposed mediation model was tested by the means of SEM methods. Since sex difference in self-esteem, depression and anxiety are well established, multi-group analysis was carried out controlling for both education and age. In order to assess invariance of the mediation model, two models were fitted to the data. Here, (i) M1 assumes that factor loadings of the latent variable of problematic internet use are invariant, and (ii) M2 assumes both factor loadings and structural paths are invariant across both sexes. According to results obtained, relative goodness-of-fit indices met their corresponding critical value for both M1 (χ^2=61.507 [χ^2_{Males}=31.190 $\chi^2_{Females}$=30.317] df=28; CFI=0.980 TLI=0.952 RMSEA=0.060 SRMR=0.024) and M2 (χ^2=71.232 [χ^2_{Males}=34.990 $\chi^2_{Females}$=36.242] df=37; CFI=0.979 TLI=0.963 RMSEA=0.053 SRMR=0.038). Because the degree of fit did not decrease significantly (Satorra-Bentler scaled χ^2 difference test = 1.124 Δdf=9 p>0.05) when all the

path coefficients were constrained to be equal in both sexes (see Figure 5), the invariance of the mediation model was supported. This means that the structural paths among the components were invariant across both sexes.

According to the results, satisfaction with body appearance had a significant direct effect on problematic internet use between both sexes. Satisfaction with body appearance had a direct significant effect on both self-esteem and on anxiety. However, no direct effect on depression was detected. Direct path from self-esteem to problematic internet use lacked significance. However, self-esteem had an indirect effect on problematic internet use primarily via depression, because between anxiety and PIUQ, the path coefficients proved to be non-significant ($p > 0.05$).

Figure 5 The mediation role of self-esteem, depression and anxiety between satisfaction with body appearance and problematic internet use



In relation to the indirect effects, only the satisfaction with 'body appearance → self-esteem → depression → problematic internet use' pathway appeared to be significant (standardized indirect effect was -0.086, $p<0.001$ for males, and -0.085 $p<0.001$ for females). The magnitude of the mediation was estimated with proportion of the mediated effect in the total effect. The mediation proportion of this pathway was 29% for both males and females. Therefore, higher satisfaction with body was associated with higher self-esteem, which is associated with lower depression, and which is linked to lower problematic internet use. All other pathways from satisfaction with body appearance were non-significant ($p>0.05$). The full model explained 33.5% of the total variance of problematic internet use among males, and 31.5% among females.

It appears that dissatisfaction with physical appearance might have a significant role in individuals immersing themselves into virtual reality media where they can disguise and/or hide their real physical characteristics and have the possibility to take on an alternative desired virtual appearance. However, we cannot exclude the possibilities that the desired

virtual appearance can also strengthen the dissatisfaction with the current appearance regardless of the users' objective physical characteristics. The significance of negative body image is also supported by comorbidity of internet addiction and eating disorders (Shapira és mtsai, 2000; Bernardi és Pallanti, 2009; Tao és Liu, 2009). Given that the relationship between dissatisfaction with bodily appearance and abnormal eating habits is generally known (Juarascio, Perone, Timko, 2011; Mäkinen, Puukko-Viertiomies, Lindberg, Siimes, Aalberg, 2012; Sonneville és mtsai, 2012), linking these fields in testing similar causal models might be a task for future empirical research.

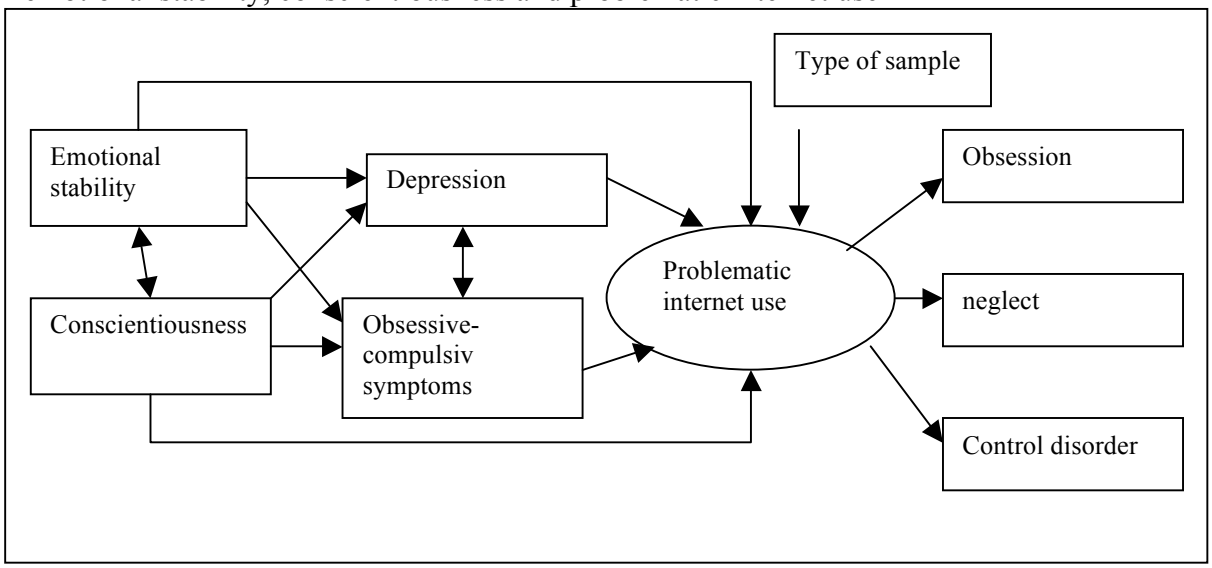
Caution must be exercise when interpreting the results of this study as it employed a cross-sectional study design utilizing self-selected and self-report data. It would be useful to extend this study with a longitudinal component in the future.

3.6. Sixth study: The role of some personality psychological traits and psychopathological symptoms in problematic internet use

3.6.1. Objective of study

There are very few studies that examine the personality psychological traits, psychopathological symptoms and problematic internet use in one complex model. Thus our aim is to develop such a complex model and test it. Since the results of the previous studies set which variables mostly associate with problematic internet use, we performed a linear regression to predict the extent of the problematic internet use. After performing the regression analysis we suggest that conscientiousness and emotional stability seem to be important issues related to problematic internet use. Among psychopathological symptoms, depression and obsessive-compulsive symptoms could be relevant. Our hypothetical model is the following:

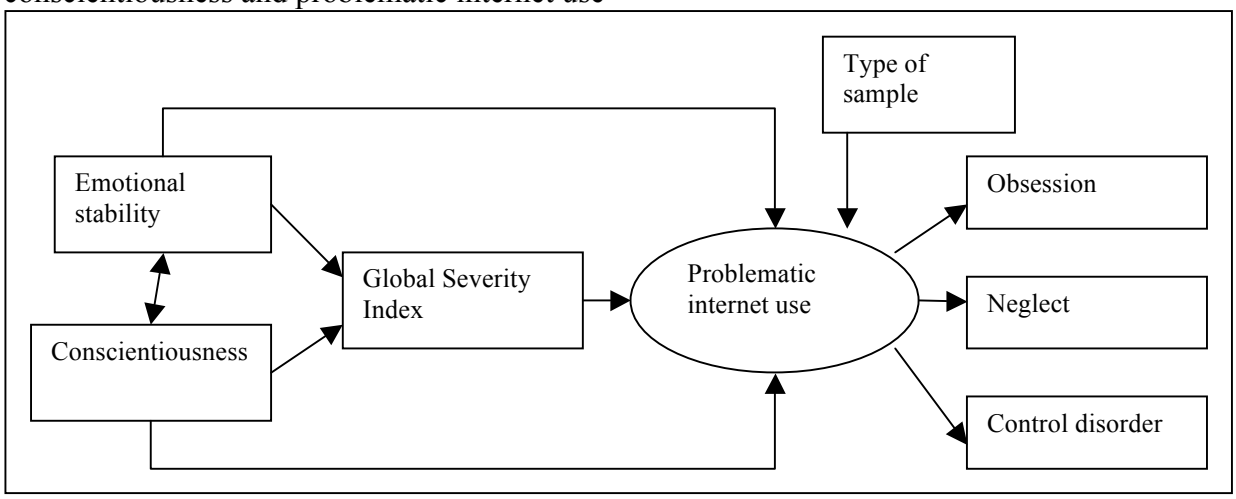
Figure 6 The mediating role of depressive and obsessive-compulsive symptoms between emotional stability, conscientiousness and problematic internet use



Some results suggest that the extent of psychopathological symptoms is increased in internet addiction (Alavi et al., 2012) – the correlational results of recent study also support

this hypothesis. Thus we want to add another mediation model to examine the mediating role of Global Severity Index related to problematic internet use.

Figure 7 The mediation role of Global Severity Index between emotional stability, conscientiousness and problematic internet use



3.6.2. Participants

The participants were from two kinds of samples. Both data collection were performed in Beijing. One of them was in an addiction clinic where the internet addicts were treated (Addiction Medicine Center of General Hospital of Beijing Military Area Command of Chinese PLA). All patients were enrolled for data collection in about a 6 months period. The other project was to collect data in internetbars in Chaoyang District of Beijing (in about 15 internetbars which were visited for 2-3 times). A Chinese assistant helped me to interview the guests of internetbar whether they would participate in the research. The proportion of the responses was about 10 %. In the internetbar there were mostly male guests, but there was no difference in the proportion of the response by sex. The package of questionnaires was avalaible online.

We excluded the participants under 18 years of age. Two persons were excluded because of missing data about sex. The final sample consisted of 222 adults. There was no female in the clinical sample, and the proportion of female respondents was 11,3 % in the internetbars. The mean age was 23,09 (SD = 4,67).

3.6.3. Measures

Problematic Internet Use Questionnaire Short Form. The Mandarin translation of PIUQ-9.

Big Five Mini-Markers (Saucier, 1994). Saucier's Mini-Markers is an abbreviated form of Goldberg's (1992) 100-item adjective checklist. This 40-item checklist provides unipolar markers for the Big-Five personality factor structure. Each participant rates how accurately each word (e.g., talkative) describes himself or herself as a person on a 7-point Likert-type scale.

Brief Symptom Inventory (Derogatis, 1993). The BFI is the short version of the Symptoms Checklist-90 (Derogatis, 1983) inquiring about psychopathological symptoms in nine dimensions: somatizations, obsession-compulsion, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, psychoticism. Additional three indeces can be computed: Global Severity Index (GSI), Positive Symptom Distress Index (PSDI), Positive Symptom Total (PST).

3.6.4. Results and discussion

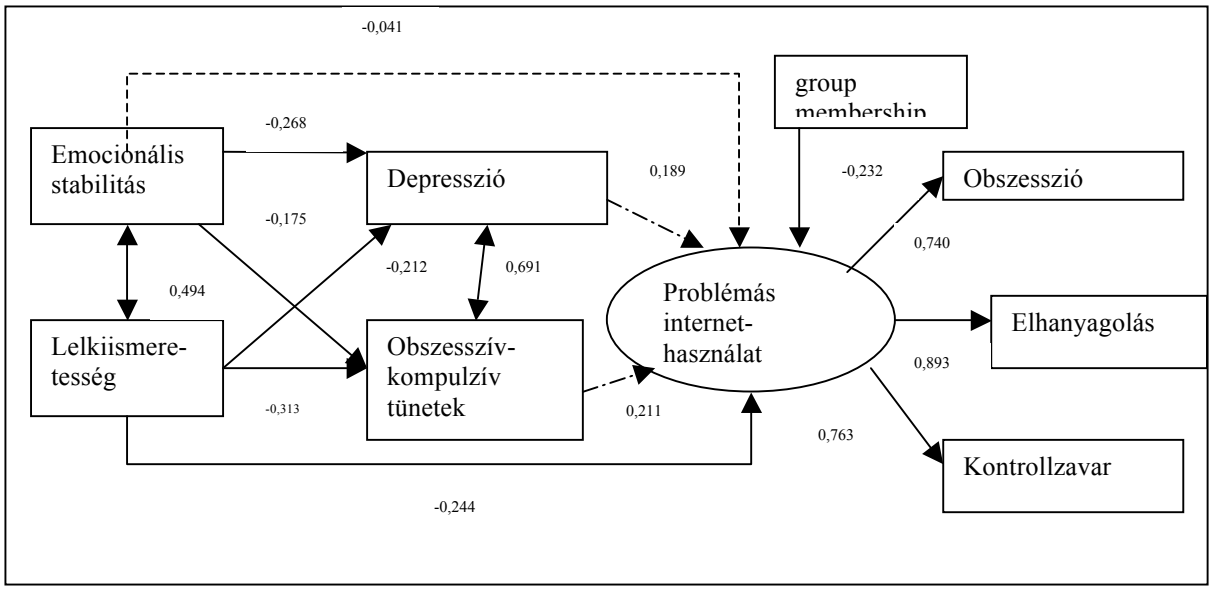
Relative goodness-of-fit indices of the first model met their corresponding critical value: χ^2=14.553 df=14 p=0.4094; CFI=0.999 TLI=0.998 RMSEA=0.013 (0.000-0.064) SRMR=0.024). According to the results obtained the direct effect of conscientiousness to the problematic internet use was significant, whereas the direct effect of emotional stability was not. The effect of the two psychopatological dimensions on problematic internet use (depressive and obsessive-compulsive symptoms) only had tendencial significance ($p<0.1$).

The associations between personality psychological dimensions, psychopathological symptoms and problematic internet use were the following. Both personality traits significantly explained the depressive and obsessive-compulsive symptoms. Conscientiousness directly effected problematic internet use, the indirect effect of this personality trait (through obsessive-compulsive symptoms) had tendency to problematic internet use (standardized indirect effect = -0.0660 p=0.086). The emotional stability only indirectly effected the problematic internet use: emotional stability – depression – problematic internet use pathway had tendency to it (standardized indirect effect = -0.051, p=0.073). Low emotional stability was associated with increased depressive and obsessive-compulsive symptoms. The more psychopathological symptoms were present in an individual, the stronger the connection was with problematic internet use. Similarly, the low conscientiousness associated with more depressive and obsessive-compulsive symptoms, additionally it effected (directly way) the problematic internet use.

Depending on which sample group did the participant belong (clinical sample vs. internetbar), the effect was differing in significance to problematic internet use: the clinical patients had more points in the PIUQ than the guest of internet bars.

The full model explained 34.8% of the total variance of problematic internet use.

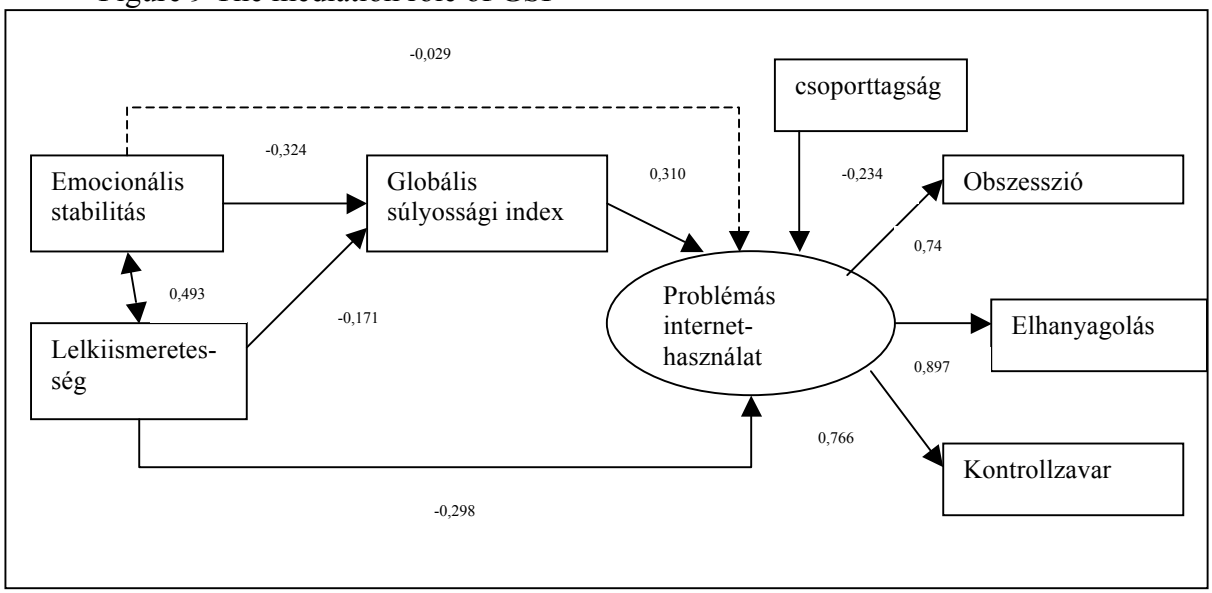
Figure 8 The mediation model of depressive and obsessive-compulsive symptoms



In the next model we changed the psychopatological symptoms to the Global Severity Index. The fit indices of second model were χ^2=9.982 df=11 p=0.5320; CFI=1.000 TLI=1.006 RMSEA=0.000 SRMR=0.027.

After reviewing the pathways (see Figure 9) we concluded that the obtained results were similar to the former model. Conscientiousness indirectly and directly, the emotional stability only indirectly showed effect (standardized indirect effect = -0.043, p>0.05) – through Global Severity Index – on problematic internet use. The pathway of „conscientiousness – Global Severity Index – problematic internet use" was not significant (standardized indirect effect = -0.043, p>0.05). The full model explained 31.7 % of the total variance of problematic internet use.

Figure 9 The mediation role of GSI



The results of the path analysis partly proved the inicial hypotheses, partly they suggest new ideas. (The tendencies mean existing associations which would gain strength in case of bigger sample.) We hypothetize that the different personality traits have different role in problematic internet use (but cause and effect could not be stated). We suggest (according to our results) that emotional stability is responsible for the extent of psychopathologic symptoms (depressive and obsessive-compulsive), whereas the low conscientiousness directly and indirectly effect problematic internet use.

These findings proved the hypothesis of impulse control disorder for internet addiction, since the low conscientiousness refer to impulsivity, and the associations between impulsivity and problematic internet use is known (Cao et al., 2007; Mottram and Fleming, 2009; Lee et al., 2012). Similarly to results related to associations between internet addiction and ADHD (Yen és mtsai, 2009b; Weiss és mtsai, 2011; Carli és mtsai, 2013), and externalized behaviors of adolescents, e.g. subtance use (Ko és mtsai, 2006; Yen és mtsai, 2009c; Fisoun és mtsai, 2012; Lee és mtsai, 2013), or the results related to research on cognitive functions, brain abnormalities of internet addicts (Dong, Zhou, Zhao, 2011b; Pawlikowski és Brand, 2011; Zhou, Yuan, Yao, 2012). On the other hand the problematic internet use as (negative) mood modification or escape from anxiety, depression (e.g. Demetrovics és mtsai, 2011; Li, Liau és Khoo, 2011; Kwon, Chung és Lee, 2011) is other important research direction which is well fitted to our recent results (about emoctional stability associated with psychopathological symptoms and finally problematic internet use).

4. Conclusions

The first part of my dissertation aimed at developing a questionnaire to measure for problematic internet use which have a good psychometric characteristics. A suitable measure should fit the following requirements: (1) Being comprehensive, examining more, possibly all, aspects of problematic Internet use; (2) Short, to be able to assess the more impulsive population as well and to fit into time-limited surveys; (3) Reliable and valid for different methods of data collection (e.g., online, paper-and-pencil self-rating, and face-toface); (4) Reliable and valid for different age groups (e.g., adolescents and adults); (5) Cross-culturally reliable and valid; (6) Validated on clinical samples; could also serve as a basis for defining cutoff scores for dependence.

Recently, we have created such a questionnaire that fulfils all the criteria, except the last one.

In our last two studies we used the PIUQ in such survey where we suggested compex models to examine associations of more psycholocical variables and problematic internet use. After path analysis we found the followings:

- The satisfaction with body appereance of the internet user negatively associated directly and non-directly way (on negative self-esteem – depression path way), it means that such person who is not satisfied with her/his physical appearance, feels herself/himself less valuable, has more depressive feelings, and is more vulnerable to maladaptive internet use.
- The emotional stability as personality trait associate with more psychopathology symptoms (depressive and obsessive-compulsive), thus indirectly it results in problematic internet use, at the same time less conscientiousness is both ways (indirecty and directy) associated with problematic internet use.

I have to mention the limitations. All the studies in recent dissertation are cross-sectional researches which do not reflect the cause-and-effect relationships. More longitudinal studies are needed for discovering them. The second limitation is that some of the six studies had convenience sampling since these were pilot-studies. The third limitation is that we used self-administered questionnaires, thus the data are liable to distortion (conscious or unconscious ways). In China there are several prohibitions in reference to internetbar, additionnally there are negative attitudes about it, therefore the data (referring e.g. age) are exposed to conscious distortion or missing data.

I concieve there is not one cause or personality type, pathology, which lead to internet addiction. I rather support there are different ways to problematic internet use. Thus it is worth conducting researches on homogeneous sample to explore the different personality

dimensions or risks leading to specific problem for internet use. Besides online gaming it would be important to examine deeply the use of social network sites and its problematic use.

After developing more precise research designs the relevancy of further studies are undoubted.

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6. Other publications

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