Internet addiction in students:

Prevalence and risk factors

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Abstract

The last decade has witnessed a large increase in research on the newly emerging mental health problem of Internet addiction. Rather than looking at Internet addiction *per se*, this study focused on particular activities on the Internet that might be potentially addictive and linked them to personality traits that might predispose individuals to Internet addiction. The aims of this study were (i) to assess the prevalence of clinically significant levels of Internet addiction, and to (ii) discern the interplay between personality traits and specific Internet uses in increasing the risk for Internet addiction. This cross-sectional online survey used data from 2,257 students of an English university. Results indicated that 3.2% of the students were classified as being addicted to the Internet. The included personality traits and uses of online activities explained 21.5% of the variance in Internet addiction. A combination of online shopping and neuroticism decreased the risk for Internet addiction, whereas a combination of online gaming and openness to experience increased it. In addition to this, frequent usage of online shopping and social online activities, high neuroticism and low agreeableness significantly increased the chances of being addicted to the Internet. Findings and their implications are discussed.

KEYWORDS: *Internet addiction, personality, online activity, risk, prevalence, students*

1. Introduction

The last decade has witnessed a large increase in research on the newly emerging mental health problem of Internet addiction (e.g. Griffiths, 2000; Young, 2010). As behavioral addiction (Holden, 2001; Kuss, 2012), Internet addiction leads to symptoms traditionally associated with substance-related addictions, namely mood modification, salience, tolerance, withdrawal, conflict, and relapse (Griffiths, 2005). The similarity with other addictions is furthermore substantiated by a multiplicity of neurobiological evidence (Kuss & Griffiths, 2012a). From a clinical perspective, Internet addiction is treated seriously and specific treatment approaches have been adopted in different countries (King, Delfabbro, Griffiths, & Gradisar, 2011), testifying to the need of professional help for those who suffer. Following the advancements in research and the increasing demand for clinical treatment, the American Psychiatric Association has decided to include "Internet use disorder" in the appendix of the upcoming fifth edition of the Diagnostic and Statistical Manual for Mental Disorders (DSM-V) (2012).

Some authors (e.g., Widyanto & Griffiths, 2006) have claimed that rather than looking at Internet addiction *per se*, researchers should focus on particular activities on the Internet that might be potentially addictive because people do not become addicted to the medium, but to the actual behavior they engage in online. In terms of specific applications, gaming has been extensively researched as an online application with a high addictive potential (Huang, 2006; Kuss & Griffiths, 2012b; Leung, 2004). Moreover, the use of social applications, namely online chatting (Huang, 2006; Leung, 2004), social networking sites (SNSs) (Kuss & Griffiths, 2011; Leung & Lee, 2012), such as *Facebook* (Kittinger, Correia, & Irons, 2012), and online instant messengers (Leung, 2004; Yuen & Lavin, 2004) have been found to be associated with Internet addiction. Furthermore, spending more time on online activities such as shopping and gaming has been linked to depressive symptoms (Morgan & Cotten, 2003). It appears that these applications may be specifically predictive of Internet addiction, however, no research has been conducted to date taking into consideration all of them in a single model.

In addition to the use of specific online activities, personality traits have been linked to Internet addiction. Higher scores on neuroticism (Dong, Wang, Yang, & Zhou, 2012; Tsai et al., 2009), and low scores on extraversion (van der Aa et al., 2009; Xiuqin et al., 2010), agreeableness and emotional stability (van der Aa, et al., 2009) have been established as potentially important risk factors for Internet addiction. Internet gaming addiction specifically has been associated with neuroticism (Mehroof & Griffiths, 2010b; Peters & Malesky, 2008), aggression and hostility (Caplan, Williams, & Yee, 2009; Kim, Namkoong, Ku, & Kim, 2008; Mehroof & Griffiths, 2010a, 2010b), introversion (Caplan, et al., 2009), social inhibition (Porter, Starcevic, Berle, & Fenech, 2010), sensation-seeking

(Mehroof & Griffiths, 2010a, 2010b), and diminished agreeableness (Peters & Malesky, 2008). In spite of the substantial evidence for the role of personality traits, far less is known about interactions between traits and specific uses of the Internet in increasing the risk of being addicted to the Internet.

In terms of risk populations, students have been identified (Widyanto & Griffiths, 2006) for several reasons. They have a natural affinity towards the Internet (Veen & Vrakking, 2006) and their conspicuous Internet literacy has been linked to Internet addiction (Leung & Lee, 2012). Moreover, they typically have (i) free and unlimited access, (ii) flexible schedules, and (iii) freedom from parental interference. Additionally, their online activities are not externally controlled, university bodies expect that they make use of the technology, and university settings can foster social intimidation and alienation (Moore, 1995; Young, 2004). Moreover, psychological and developmental factors associated with young adulthood may contribute to the allure of the Internet for students. They do not only find themselves in the process of developing their identities, but they also start to establish intimate relationships at that particular stage of their lives. To develop one's identity means to become detached from one's parents to a certain extent leading to internal conflicts which are repeatedly resolved by the escape into addictions of all sorts, including Internet addiction (Lanthier & Windham, 2004). Accordingly, the Internet can become a source of self-medication (Castiglione, 2008).

Allied to this, the forming of online relationships is more facile than doing the same in real life. On the Internet, people disclose personal information more readily because of the anonymity of the medium (Kandell, 1998; Mantovani, 2001). By the same token, young students may be hampered in the processes of forming an individual identity and establishing real, meaningful and intimate relationships outside of the arena of the virtual world. In addition to this, students are likely to create a new student culture which necessitates the Internet as a tool for communication, information sharing and community formation (Kandell, 1998). Some studies have shown that as many as six in ten students jeopardize their academic and professional performance because of their Internet habits (Kubey, Lavin, & Barrows, 2001; Young, 1998), and that in order to cope, they engage in Internet activities excessively (Castiglione, 2008).

In university student populations, Internet addiction prevalence estimates range from 0.8% in Italy (Poli & Agrimi, 2012), 0.9% in Jordan (Al-Qudah, 2001), 2.8% in Iran (Ghamari, Mohammadbeigi, Mohammadsalehi, & Hashiani, 2011), 5.6% in China (Dong, et al., 2012), 9.8% in the USA (Anderson, 2001), to 15.1% in Taiwan (Lin, Ko, & Wu, 2011), 16.2% in Poland (Lićwinko, Krajewska-Kułak, & Łukaszuk, 2011), and 18.3% in Great Britain (Niemz, Griffiths, & Banyard, 2005). However, the wide range of prevalence estimates indicates that the variety of psychometric instruments utilized does

not allow for a clear determination of actual prevalence rates for Internet addiction. None of the above studies have made use of assessment tools that allow for a determination of clinically relevant Internet addiction. Furthermore, and to the authors' knowledge, no study (to date) has ever assessed the interactions between the usage of specific Internet applications and personality traits as risk factors for Internet addiction. In the present study, these shortcomings will be overcome. In order to address the gaps in empirical knowledge, the aims of this study were (i) to assess the prevalence of clinically significant levels of Internet addiction in an English student sample, and to (ii) discern the interplay between personality traits and specific Internet uses in increasing the risk for Internet addiction. Based on previous research, in the present study, the hypotheses were that (i) the use of Internet applications that allow social functions (i.e., SNSs, chatting, forums, messengers) and gaming would be strong risk factors for Internet addiction, and (ii) the particular personality traits (i.e, high neuroticism, low extraversion, and low agreeableness) would be risk factors for Internet addiction.

2. Method

2.1 Design: This study used a cross-sectional online data gathering technique. Emails were sent to students' personal email accounts and contained information about the study as well as the link to the online questionnaire. The total questionnaire contained 120 questions and required approximately 15 minutes to complete.

2.2 Participants: A convenience sample comprising 2,257 students from an English university in the East Midlands participated in the study. The sample characteristics are presented in Table 1. The mean age was 22.67 years (*SD* = 6.34 years), with a range from 18 to 64 years. In terms of gender distribution, approximately one-third of the sample was male and two-thirds female. Participants were from 94 countries, 78.1% were born in the United Kingdom, 8.7% in another European country, 7.2% in Asia, and 3.4% in Africa. The majority (82.8%) were studying for an undergraduate degree, with 14.1% and 3.1% studying for a Master's' degree and a PhD degree, respectively. Most students identified humanities as their primary discipline (45.8%), with social sciences and life sciences being identified by 29.2% and 25.1%, respectively. The students had used the Internet for an average of 9.9 years (SD = 2.9 years).

Table 1: *Sociodemographics of Total Sample and Subsamples of Not Addicted and Addicted Students*

Students (N = 2,257)	N	Percent of total	Not addicted (n)	Percent of total	Addicted (n)	Percent of total	Overall χ^2	Effect size[a]
Age (years)								
Mean (*SD*)	22.67 (6.34)		22.69 (6.36)		22.26 (5.69)			
18-21 years	1366	62.0	1321	59.9	45	2.0		
22-25 years	473	21.5	457	20.7	16	0.7		
26-30 years	168	5.3	161	7.3	7	0.3		
31-40 years	116	5.3	115	5.2	1	0		
41-65 years	82	3.7	80	3.6	2	0.1	2.78	CV = .01
Sex								
Male	794	35.6	767	34.4	27	1.2		
Female	1438	64.6	1396	62.5	42	1.9	0.39	η = .01
Relationship status								
Yes	307	13.8	302	13.6	5	0.2		
No	1910	86.2	1848	83.4	62	2.8	2.36	η = .03
Field of study								
Humanities	972	45.8	944	44.5	28	1.3		
Social sciences	619	29.2	602	28.4	17	0.8		
Natural sciences	532	25.1	514	24.2	18	0.8	0.45	CV = .02
Level of study								
Bachelor's	1555	82.8	1505	80.1	50	2.7		
Master's	264	14.1	255	13.6	9	0.5		
Doctorate	59	3.1	59	3.1	0	0	2.00	CV = .03

Note1. A respondent is classified as "addicted user" when he or she scored >13 on the AICA-S.

Note2. Due to missing values, the sum total of participants may not equal 2,257 for each variable analysed.

[a]Effect size CV = Cramer's V

2.3 Materials (measurement instruments): In addition to basic demographic information, the online survey comprised a number of different psychometric tools to assess Internet addiction and personality traits.

2.3.1 Internet addiction: In order to assess Internet addiction, the Assessment for Computer and Internet Addiction-Screener (AICA-S; Wölfling, Müller, & Beutel, 2010) was used. The screener is a brief self-report instrument, based on the original Scale for the Assessment of Pathological Computer Gaming (Wölfling, Müller, & Beutel, 2011). The AICA-S includes questions relating to key sociodemographic data as well as structural provisions, such as Internet access and the onset of Internet use. More specifically, it targets the frequency of specific Internet usage domains, such as

online games, shopping, gambling, emails, chats/forums, social networking, messengers, and information research. Additionally, it enquires into associated negative consequences and the extent to which usage is pathological from a diagnostic point of view. Fourteen out of the total sixteen main questions are used in order to accumulate a clinical score, on the basis of which the participants' online usage behavior can be categorized in normal or addictive (from 13.5 points onwards) (Müller & Wölfling, 2011).

The individual diagnostically relevant items derive from the diagnostic criteria of substance dependence as specified by the international classification manuals, the DSM-IV-TR (APA, 2000) and the ICD-10 (Dilling, Mombour, & Schmidt, 2000). These include craving, tolerance, withdrawal, loss of control, preoccupation and negative consequences concerning poorer health, family conflicts or deteriorating achievements (Wölfling, et al., 2010). A recent literature review of empirical studies assessing online gaming addiction to date indicates that the applicability of substance dependence criteria for Internet addiction appears valid over and above other classification efforts (Kuss & Griffiths, 2012c)**.** In addition to these addiction criteria, the AICA-S enquires into further scientifically relevant themes associated with Internet addiction, namely mood modification[1] (Item 11, which asks how frequently the participant is online in order to avoid negative feelings, such as boredom or sorrow), as well as quantitative and qualitative usage measures (such as Item 1 assessing mean online hours per day, compared to Item 3, which enquires into the frequency of Internet usage on the basis of the following answer options: every day, 2-3 times a week, once a week, once a month or less than once a month). In terms of its psychometric qualities, the AICA-S is reliable in its measure of Internet addiction and it is valid in terms of assessing Internet addiction exclusively and accurately (Wölfling, et al., 2010).

2.3.2 Personality measures: Personality traits were assessed using the NEO Five-Factor Inventory (NEO-FFI; Costa & McCrae, 1992b). It is a valid and reliable instrument for measuring basic personality traits that stem from a variety of personality frameworks and language uses related to personality as well as statistical factor analyses. The NEO-FFI is the 60-item self-report short version of the original NEO-Personality Inventory-Revised (NEO-PI-R; Costa & McCrae, 1992a) and measures the big five personality traits. The first one, Neuroticism, is associated with anxiety, angry hostility, depression, self-consciousness, impulsiveness, and vulnerability. The second, Extraversion, is characterized by warmth, gregariousness, assertiveness, activity, excitement-seeking, and positive emotions. The third, Openness to Experience, includes fantasy, aesthetics, feelings, actions, ideas, and values. The fourth, Agreeableness, relates to trust, straightforwardness, altruism, compliance,

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[1] The relationship between behavioral addictions generally and Internet addiction specifically and mood modification is confirmed in empirical studies conducted by Grüsser and Thalemann (2006) as well as Holden (2001).

modesty, and tendermindedness. Finally, the fifth, Conscientiousness, is distinguished by competence, order, dutifulness, achievement striving, self-discipline, and deliberation (Costa & McCrae, 1992b).

3. Results

Results indicated that 3.2% of the students in the present sample were classified as being addicted to the Internet. Initially, students who were classed as addicted to the Internet and those who were not were compared regarding (i) their overall Internet use, (ii) the number of problems they experienced, and (iii) their AICA-S scores. This was done using independent samples t-tests assuming unequal variances due to the unequal group sizes. For the main analyses, the assumptions of linearity, independence of errors, and multicollinearity of the relevant variables were checked. For all analyses, weighted data were used in order to balance out the unequal gender distribution, and predictors were centered at their mean to evade multicollinearity problems of the interaction terms (Aiken & West, 1991). Following the inspection of data regarding the assumptions that yielded a satisfactory results, a logistic regression analysis was performed with Internet addiction status as binary outcome variable (i.e., the dependent variable was addicted versus not addicted) and the main effects of all application uses and all personality traits as predictors. In addition to this, gender was added. Male gender has been repeatedly claimed to be a risk factor for Internet addiction (Leung & Lee, 2012; Tsai, et al., 2009). Due to the absence of significant gender differences in the sample, gender was excluded from any further analyses. This also allowed for the development of a more parsimonious model. The significant predictors as well as all interactions between the significant personality traits and the significant Internet application uses were included in another logistic regression analysis. The final model includes all significant interactions as well as the relevant main effects predictive of Internet addiction. In order to discern the simple effects, linear regression analyses were performed.

As presented in Table 2, the addicted students used the Internet significantly longer than the non-addicted students for leisure purposes on weekdays ($t(53.76) = -2.10$, $p < .05$), and weekend days ($t(55.11) = -7.28$, $p < .01$). All of the addicted students used the Internet every day, compared to 91.7% of the non-addicted students. Moreover, the addicted students experienced significantly more problems due to their Internet use compared to the non-addicted students ($t(62.68) = -12.41$, $p < .01$). Finally, the addicted students scored significantly higher on the AICA-S than the non-addicted students ($t(77.57) = -44.19$, $p < .01$).

Table 2: *Internet Use and Internet Addiction in Addicted and Not Addicted Students*

	Addicted (*n* = 71)	Not addicted (*n* = 2,160)	
	M (*SD*)	*M* (*SD*)	*t*(df)
Internet use			
Hours/weekdays	7.79 (9.52)	5.05 (5.55)	2.10* (53.76)
Hours/weekend days	8.47 (4.05)	4.39 (3.56)	7.28** (55.11)
Addiction			
AICA-S score	15.66 (2.02)	4.71 (2.66)	44.19* (77.57)
Number of problems	3.61 (1.54)	1.12 (1.36)	12.41** (62.68)

** p < .01; * p < .05.

Table 3: *Logistic Regression of Personality and Internet Application Use on Internet Addiction*

		95% CI for Exp(B)		
	B (SE)	Lower	Exp(B)	Upper
Constant	-4.35 (.23)			
Shopping*Neuroticism	-.60* (.26)	.33	.55	.91
Games*Openness	.50* (.24)	1.01	1.64	2.64
Chats/forums	.47** (.13)	1.24	1.60	2.08
Shopping	.86** (.24)	1.48	2.35	3.74
Messengers	.42** (.14)	1.15	1.52	2.00
SNSs	.59* (.25)	1.11	1.81	2.95
Games	.18 (.14)	.91	1.20	1.56
Neuroticism	1.20** (.21)	2.10	3.33	5.05
Agreeableness	-.61* (.26)	.33	.54	.91
Openness	.41 (.26)	1.50	1.03	2.52

The baseline model including no predictors was significant (b = -3.340, Wald X^2 (1) = 761.17, $p < .01$), indicating that the chance for being addicted to the Internet by the overall study population was .03. In comparison, the final model as presented in Table 3 predicted Internet addiction status significantly (X^2(10) = 115.53, $p < .01$) and explained 21.5% of the variance in scores (Nagelkerke's R^2 = .215). In terms of personality traits, neuroticism was the strongest predictor of Internet addiction (b = 1.20, Wald X^2 (1) = 31.81, $p < .01$). Moreover, every unit increase in neuroticism increased the odds to be addicted to the Internet by 233%. Students addicted to the Internet scored significantly higher on the NEO subscale of neuroticism (M = 3.44, SD = 0.69) than non-addicted students (M = 2.90, SD = 0.70, X^2 = 170.91, $p < .01$).

The second personality trait predictive of Internet addiction was agreeableness (b = -.61, Wald X^2 (1) = 5.47, $p < .05$). Every unit increase in the agreeableness score decreased the odds of being addicted to the Internet by 46%. Students addicted to the Internet scored significantly lower on the NEO subscale of agreeableness (M = 3.31, SD = 0.58) than non-addicted students (M = 3.55, SD = 0.49, X^2 = 130.10, $p < .01$). In addition to this, students addicted to the Internet scored significantly higher on the NEO subscale of openness (M = 3.47, SD = 0.49) than non-addicted students (M = 3.33, SD = 0.50, X^2 = 120.59, $p < .01$).

Regarding Internet application use, online shopping appeared as the strongest predictor of Internet addiction (b = .86, Wald X^2 (1) = 13.06, $p < .01$). Every unit increase in online shopping increased the odds of being addicted to the Internet by 135%. Addicted students scored significantly higher on online shopping (M = 2.16, SD = 0.74) than not addicted students (M = 1.87, SD = 0.72, X^2 = 11.84, $p < .01$). Furthermore, all social applications significantly increased the odds of being addicted to using the Internet. The use of social networking sites increased the odds by 81% (b = .59, Wald X^2 (1) = 5.62, $p < .05$), chat rooms and forums increased the odds by 60% (b = .47, Wald X^2 (1) = 12.66, $p < .01$), and using instant messengers increased the odds by 52% (b = .42, Wald X^2 (1) = 8.82, $p < .01$). Compared to non-addicted students, addicted students scored significantly higher on their use of social networking sites (M = 2.78, SD = 0.57, vs. M = 2.53, SD = 0.80, X^2 = 10.36, $p < .05$), online chat rooms and forums (M = 1.40, SD = 1.12, vs. M = 0.80, SD = 0.87, X^2 = 48.71, $p < .01$), and online instant messengers (M = 2.06, SD = 0.99, vs. M = 1.51, SD = 0.97, X^2 = 40.40, $p < .01$).

In addition to the significant main effects, two interactions appeared as important predictors of Internet addiction. Firstly, the interaction between openness to experience and online gaming increased the odds of being addicted to the Internet by 64% (b = .50, Wald X^2 (1) = 4.20, $p < .05$). On closer inspection of the simple effects (see Figure 1), it appeared that in the addicted group, openness to experience significantly predicted the extent of online gaming (b = .55; F (1) = 4.43, $p < .05$; R^2 = .06). No such effect was discerned in the non-addicted group (b = .03; F (1) = .74, ns).
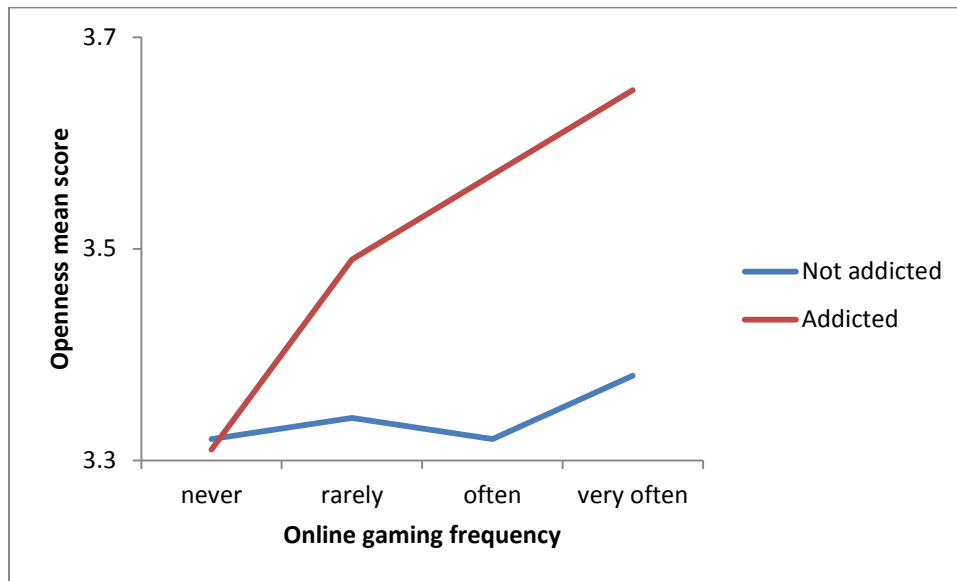
Figure 1: *Interaction Effect of Gaming Frequency and Openness on Internet Addiction*

Secondly, the interaction between neuroticism and online shopping decreased the odds of being addicted to the Internet by 45% (b = -.60, Wald X^2 (1) = 5.50, p < .05). On closer inspection of the simple effects (see Figure 2), it appeared that in the addicted group, neuroticism significantly predicted the extent of online shopping (b = -.30; F (1) = 5.70, p < .05; R^2 = .08). No such effect was discerned in the non-addicted group (b = .03; F (1) = 1.38, *ns*).
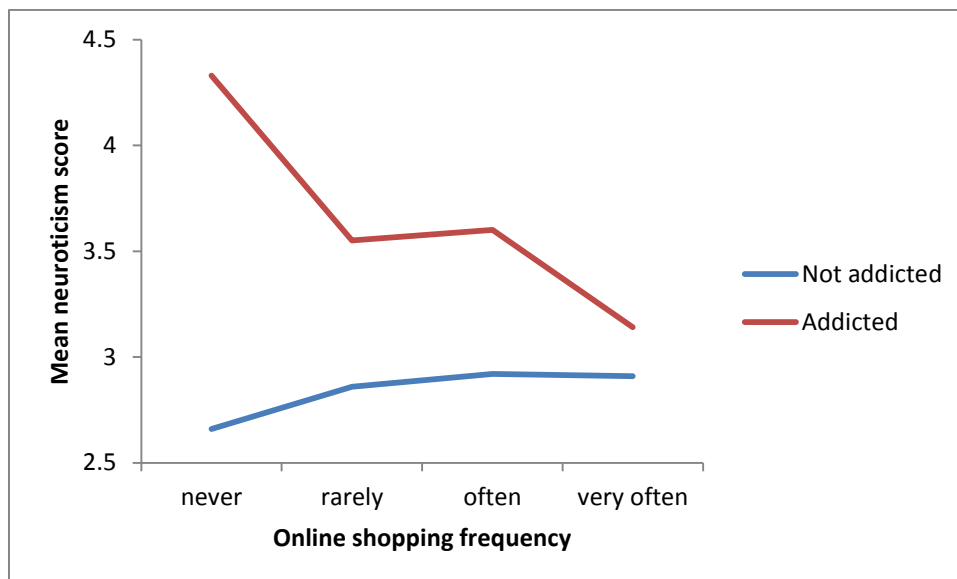

Figure 2: *Interaction Effect of Online Shopping Frequency and Neuroticism on Internet Addiction*

4. Discussion

In this study, the risk for Internet addiction was assessed on the basis of the interactions between personality traits and the use of specific Internet applications with an assessment tool that allowed for a determination of clinically relevant Internet addiction. To the authors' knowledge no previous studies have done this. Based on the clinical self-report tool utilized, it was found that a total of 3.2% of the students in the present sample were classified as being addicted to the Internet. The prevalence in this student sample appears to be situated on the rather conservative end of Internet addiction estimates in students from a variety of countries that range from 0.8% (Poli & Agrimi, 2012) to 18.3% (Niemz, et al., 2005). The very high estimate of nearly 20% in Niemz et al.'s study is the only prevalence estimate available for English students so far. Rather than assessing established and validated addiction criteria as based on the diagnostic manuals, it merely inquired into problems due to extensive use. In contrast, the AICA-S assesses Internet addiction as based on actual diagnostic criteria and is used in daily clinical practice, making it the only diagnostic tool of its kind utilized to date. Consequently, rather than limiting the pathological classification to the presence of individual impairments, the AICA-S can be seen as initial indicator for real and potentially clinically relevant maladaptive behaviors. Therefore, the rather conservative prevalence of 3.2% found here appears reasonable and substantiated.

Regarding the hypotheses, it was found that the use of all social applications significantly increased the risk for being addicted to the Internet, which is in line with the hypotheses concerning the use of specific online applications. Some previous research has indicated that communication pleasure is the strongest predictor of Internet addiction (Chou & Hsiao, 2000), which is supportive of the present conjecture indicating that extensive use of social online applications is a risk factor for Internet addiction. Of all the online applications examined in this study, it was the use of SNSs that most increased the risk of being addicted to the Internet (i.e., 81% increased chance). In light of the empirical evidence base, this finding appears corroborated. To date, the literature base investigating SNS addiction is reasonably scarce. However, it suggests that SNSs are mostly used for the maintenance of established offline networks that are important for academic and professional opportunities, and thus might explain why some individuals become addicted to using them (Kuss & Griffiths, 2011). The most prominent SNS with more than 900 million users worldwide, *Facebook,* was in fact specifically developed as a virtual community for students (Carlson, 2010), and therefore it may not be surprising that it is students who use it excessively and in a potentially addictive manner. Interestingly, recent research indicates that females may appear to be a particular population at risk (Andreassen, Torsheim, Brunborg, & Pallesen, 2012), which indicates that further research into this aspect is required.

The next Internet application that significantly increased the risks of being addicted to the Internet was online chat/forums (i.e., increased chance by 60%). Unlike SNSs and instant messengers, chat rooms and forums are commonly used to interact with strangers and/or virtual acquaintances rather than real life friends (Wellman & Gulia, 1999). In a previous study (Whitty, 2002), it was found that people tend to use chat rooms for emotional support and this may indicate that when there is no emotional support available in the real life setting, a person is more likely to turn to the Internet for this purpose. Students who have just left their familiar home surroundings, study in different cities and/or countries may feel more alienated and start using chat functions of the Internet to excess. This explanation is supported by other research (Simkova & Cincera, 2004), indicating that students who use online chat functions are more likely to be addicted to the Internet relative to other students.

Online forums, on the other hand, can be used for a variety of purposes, such as being a platform for knowledge collection as well as discussion (Cheng, Liu, & Shieh, 2012). Furthermore, similar to online chat rooms, online forums may serve the function of giving and receiving support (Morrow, 2006) in a variety of domains, such as occupational problems (Deryakulu & Olkun, 2007), and providing professional advice to those struggling with their physical and/or mental health (Smithson et al., 2011; Welz et al., 2011). As with online chat rooms, online forums may be a substitute for real life contacts, and engagement with them could lead to excess, as suggested by the results of this study. However, it needs to be noted that in this study, the online usage of chat rooms and forums was assessed together. Unlike forums, chat rooms are a synchronous mode of communication, and therefore require direct interaction in real time. Alternatively, the asynchronicity of forums may potentially have a different effect on the risk of developing Internet addiction. Therefore, merging the use of chat rooms and forums may have decreased the specificity of measure because it is unclear to what extent the usage of each of these Internet applications was specifically a risk factor for Internet addiction.

The final social Internet application to increase the risk for being addicted to the Internet was online instant messaging (i.e., increased chance by 51%). Previous research has found that the reasons for increased use of instant messengers (e.g., ICQ, MSN) in young populations are media richness and presentational control (Sheer, 2010). Moreover, previous research suggests that in addition to being emotionally open online, heavy use of the messenger ICQ predicts problematic Internet use over and above the use of any other online (social) Internet application (Leung, 2004). Synchronous communication tools such as ICQ may be used in order to modify mood and to escape real lives and real life problems, and could therefore result in the development of problematic behaviors (Wellman, 1996), that are in turn exacerbated through a simultaneous retreat from real life

relationships (Leung, 2004). This may therefore result in a vicious cycle in such a way that real life problems lead to escape via Internet usage, which in turn increases those problems, so that the students find even more reason to continuously engage in online activities.

This study also demonstrated that engaging in online gaming increased the risks of being addicted to the Internet when paired with higher openness to experience. Students who played online games frequently and whose scores on the NEO-FFI subscale for openness were elevated at the same time, had a 64% increased risk of being addicted to the Internet. This is an original finding that has yet to be replicated. Increased novelty seeking that is linked to openness to experience has been associated with Internet addiction (Ko et al., 2010). Moreover, it appears from research into substance dependence that openness to experience is associated with marijuana use, which differentiates the latter from any other drug users (Terracciano, Löckenhoff, Crum, Bienvenu, & Costa, 2008). The associations between marijuana addicts and Internet gaming addicts with regards to higher openness to experience require further examination in the future.

For the first time in any empirical study, online shopping was found to be a significant risk factor for Internet addiction in a university student population. Frequent engagement in this activity significantly increased the odds for being addicted to the Internet by 81%. Students shop online because of convenience, price, and larger selection of products (Delafrooz, Paim, & Khatibi, 2010), customer service (Ahuja, Gupta, & Raman, 2003), anonymity and pleasure (Kukar-Kinney, Ridgway, & Monroe, 2009). Anonymity and pleasure have been found to have strong correlations with compulsive buying, indicating that the absence of social interaction and the possibility to buy unobserved may facilitate compulsive shopping behaviors online (Kukar-Kinney, et al., 2009). In light of students who spend large amounts of their time online for the purpose of research, coursework, and socializing, online procrastination may potentially lead to shopping excess. On the one hand, they may devote large amounts of time to researching the best deal, which, on the other hand, will reward them with a pleasurable experience that is just one click away.

Counter-intuitively, this study found that Internet addicts who shopped online frequently had decreased neuroticism scores. High neuroticism has been repeatedly linked with Internet addiction (Dong, et al., 2012; Tsai, et al., 2009), and was found to increase the odds of being addicted to the Internet by 233% (making it the strongest predictor in the present study). Due to the increased odds for Internet addiction as a consequence of both frequent shopping and high neuroticism, it would be expected that an interaction of the two would have a similar effect on increasing the risk. However, the interaction between online shopping and neuroticism decreased the odds for being addicted to the Internet by 45%. From a hedonistic viewpoint, this finding could be explained by the speculation that in order to make themselves feel better, neurotics shop online frequently, which in turn reduces

their perceptions of depression and anxiety, which are commonly associated with neuroticism. Just as neurotics are found to use drugs such as nicotine for the purpose of self-medication (McClernon, Hiott, Westman, Rose, & Levin, 2006), students' use of online shopping in this study may fulfill a similar purpose. This finding is unprecedented and adds to our knowledge about the associations between both problematic and specific uses of the Internet and personality.

Low agreeableness increased the risk of Internet addiction by 46%. Low agreeableness corresponds to what Zuckerman identified as *aggression-hostility* (Zuckerman, 2002). In a previous study, aggressive behaviors were linked to Internet addiction in adolescents after controlling for watching violence on television (Ko, Yen, Liu, Huang, & Yen, 2009). The authors explained this relationship by arguing that online anonymity may lead to a decrease of personal responsibility and deindividuation (Zimbardo, 1969). Online disinhibition (Joinson, 1998) as demonstrated in flaming and other aggressive behaviors on the Internet may therefore be transferred into real life (Ko, et al., 2009), and may have significant negative consequences both for the addicted individual as well as their interpersonal relations both online and offline.

Unlike the predicted hypothesis, the scores on the extraversion subscale of the NEO-FFI did not have an influence on the risk of being addicted to the Internet. This could be explained by previous findings indicating that both extraversion as well as introversion may play a role in the extent of Internet use (Ross et al., 2009; Zywica & Danowski, 2008). People with large offline social networks, who are more extroverted, and who have higher self-esteem, use online networks for social enhancement, supporting the principle of 'the rich get richer'. On the other hand, people with only a limited number of real life contacts compensate for their introversion, low self-esteem, and low life-satisfaction by using SNSs for online popularity, thus supporting the social compensation hypothesis of 'the poor get richer' (Barker, 2009; Ellison, Steinfield, & Lampe, 2007; Mehdizadeh, 2010). Therefore, high introversion and high extraversion scores, respectively, might have cancelled out each other's effects on Internet addiction in the present study.

Overall, the included variables explained 21.5% in the variance of addiction. Compared to prior studies, this percentage is relatively low. For instance, Hsu, Wen, and Wu (2009) conducted a study on addiction and found five experience factors, curiosity, role playing, belonging, obligation, and reward predict addiction. In their study, the five factors predicted 65.1% of the variance in addiction. The relatively low R square value in this study may indicate there are still some other risk factors that require further study in order to explain Internet addiction. In addition, the present study examined the risk of addiction using a clinically verified cut-off point, whereas Hsu et al. (2009) looked at the extent of addiction from a dimensional point of view that may have contributed to dissimilar explained variances.

4.1 Limitations: The present study is not without its limitations. Firstly, other Internet applications that have not been assessed here (i.e., the use of YouTube, online video streaming, online support groups, etc.) may also impact upon Internet addiction. These online applications and their relationship with excessive and/or addictive use need to be evaluated in the future. Secondly, the AICA-S does not specifically address a time criterion in determining Internet addiction status. Therefore, researchers are encouraged to replicate the findings by examining the occurrence of the specified addiction symptoms within the period of the last twelve months, as utilized for substance dependence (American Psychiatric Association, 2000). In addition to this, it needs to be noted that a self-report tool in and of itself can never be the sole criterion upon which to base an actual mental health diagnosis. It can merely be an indicator of potentially addictive behaviors. Therefore, it is recommended that ideally, self-reports should be supplemented with that of significant others' reports and/or a professional assessment via a structured clinical interview (Beard, 2005). Thirdly, a convenience sample was used which limits the generalizability of findings beyond English university populations. Bearing this in mind, cross-cultural comparisons using the same measurement instruments are warranted. Fourthly, as gender did not significantly increase the risk of being addicted to the Internet, it was excluded from further analyses in line with our aim to arrive at a parsimonious model. This does not preclude the possibility that gender interacts with one or more of the other predictors in increasing Internet addiction risk. Therefore, care should be taken in future studies that focus on gender to investigate these relationships further.

4.2 Implications and conclusions: Overall, the present study integrated previous findings concerning the influence of both, specific personality traits, as well as the usage of particular Internet applications, into a coherent framework, drawing on previous literature. In addition to this, for the first time, it showed the interaction of the assessed variables in increasing the risk factors for being addicted to the Internet. Findings from this research have implications for university and government bodies who may put regulatory mechanisms in place that limit the usage of potentially addictive Internet applications particularly for those students whose personality puts them at risk for developing Internet addiction. In terms of prevention, children and adolescents with specific risk factors may be targeted via their schools to educate them about the potential risks the problematic engagement with specific online applications can bring about. Furthermore, clinicians will benefit from this piece of research as findings of the present results may aid them in developing targeted treatment approaches that benefit high-risk individuals by tailoring therapy according to their individual needs. Finally, this research informs future studies that may specifically (i) replicate the original findings (i.e., the specific interaction effects) (ii) in other populations, and potentially (iii) supplement the self-reports with additional diagnostic tools, such as professional interviews, and (iv) assess the extent to which gender mediates the detected findings. In sum, the present research adds

to the current pool of knowledge that substantiates the American Psychiatric Association's endeavours of including *Internet Use Disorder* in the upcoming version of the DSM.

References

Ahuja, M., Gupta, B., & Raman, P. (2003). An empirical investigation of online consumer purchasing behavior. *Communications of the ACM, 46*(12), 145-151.

Aiken, L. S., & West, S. G. (1991). *Multiple regression: Testing and interpreting interactions*. Newbury Park: Sage.

Al-Qudah, K. (2001). Internet addiction among students at Jordanian universities. *Journal of Arabic and Human Sciences, 4*(2), 71-88.

American Psychiatric Association. (2000). *Diagnostic and Statistical Manual for Mental Disorders IV, Text-Revision*. Washington, D. C.: American Psychiatric Association.

American Psychiatric Association. (2012). R 40 Internet Use Disorder. *DSM-5 development.* Retrieved 07.09.2012, from
http://www.dsm5.org/ProposedRevision/Pages/proposedrevision.aspx?rid=573#

Anderson, K. J. (2001). Internet use among college students: An exploratory study. *Journal of American College Health, 50*(1), 21-26.

Andreassen, C. S., Torsheim, T., Brunborg, G. S., & Pallesen, S. (2012). Development of a Facebook Addiction Scale. *Psychological Reports, 110*(2), 1-17.

Barker, V. (2009). Older adolescents' motivations for social network site use: The influence of gender, group identity, and collective self-esteem. *CyberPsychology & Behavior, 12*(2), 209-213.

Beard, K. W. (2005). Internet addiction: A review of current assessment techniques and potential assessment questions. *Cyberpsychology & Behavior, 8*(1), 7-14.

Caplan, S. E., Williams, D., & Yee, N. (2009). Problematic Internet use and psychosocial well-being among MMO players. *Computers in Human Behavior, 25*(6), 1312-1319.

Carlson, N. (2010). At last - The full story of how Facebook was founded. Business Insider. Retrieved 02.08.2012, from http://www.businessinsider.com/how-facebook-was-founded-2010-3#

Castiglione, J. (2008). Internet abuse and possible addiction among undergraduates: A developing concern for library and university administrators. *Library Review, 57*(5), 358-371.

Cheng, S. S., Liu, E. Z. F., & Shieh, R. S. (2012). Identifying the indicators attracting users to online question and answer discussion forums. *Social Behavior and Personality, 40*(2), 283-292.

Chou, C., & Hsiao, M. C. (2000). Internet addiction, usage, gratification, and pleasure experience: The Taiwan college students' case. *Computers & Education, 35*(1), 65-80.

Costa, P. T., & McCrae, R. R. (1992a). *NEO PI-R professional manual*. Odessa, TX: Psychological Assessment Resources.

Costa, P. T., & McCrae, R. R. (1992b). *Revised NEO personality inventory (NEO-PI-R) and the NEO Five-Factor inventory (NEO-FFI): Professional manual*. Odessa, FL: Psychological Assessment Resources.

Delafrooz, N., Paim, L. H., & Khatibi, A. (2010). Students' online shopping behavior: An empirical study. *Journal of American Science, 6*(1), 137-147.

Deryakulu, D., & Olkun, S. (2007). Analysis of computer teachers' online discussion forum messages about their occupational problems. *Educational Technology & Society, 10*(4), 131-142.

Dong, G., Wang, J., Yang, X., & Zhou, H. (2012). Risk personality traits of Internet addiction: A longitudinal study of Internet-addicted Chinese university students. *Asia-Pacific Psychiatry*, e-pub ahead of print.

Ellison, N. B., Steinfield, C., & Lampe, C. (2007). The benefits of Facebook "friends": Social capital and college students' use of online social network sites. *Journal of Computer-Mediated Communication, 12*(4).

Ghamari, F., Mohammadbeigi, A., Mohammadsalehi, N., & Hashiani, A. A. (2011). Internet addiction and modeling its risk factors in medical students, iran. *Indian Journal of Psychological Medicine, 33*(2), 158-162.

Griffiths, M. (2000). Internet addiction - Time to be taken seriously? *Addiction Research, 8*(5), 413-418.

Griffiths, M. D. (2005). A "components" model of addiction within a biopsychosocial framework. *Journal of Substance Use, 10*, 191-197.

Grüsser, S. M., & Thalemann, C. N. (2006). *Verhaltenssucht - Diagnostik, Therapie, Forschung*. Bern: Hans Huber.

Holden, C. (2001). Compulsive behaviors: "Behavioral" addictions: Do they exist? *Science, 294*(5544), 980-982.

Hsu, S. H., Wen, M. H., & Wu, M. C. (2009). Exploring user experiences as predictors of MMORPG addiction. *Computers & Education, 53*(2), 990-999.

Huang, Y.-R. (2006). Identity and intimacy crises and their relationship to Internet dependence among college students. *CyberPsychology & Behavior, 9*(5), 571-576.

Joinson, A. N. (1998). Causes and effects of disinhibition on the Internet. In J. Gackenback (Ed.), *The psychology of the Internet* (pp. 43-60). New York, NY: Academic Press.

Kandell, J. J. (1998). Internet addiction on campus: The vulnerability of college students. *CyberPsychology & Behavior, 1*(1), 11-17.

Kim, E. J., Namkoong, K., Ku, T., & Kim, S. J. (2008). The relationship between online game addiction and aggression, self-control and narcissistic personality traits. *European Psychiatry, 23*, 212-218.

King, D. L., Delfabbro, P. H., Griffiths, M. D., & Gradisar, M. (2011). Assessing clinical trials of Internet addiction treatment: A systematic review and CONSORT evaluation. *Clinical Psychology Review, 31*(7), 1110-1116.

Kittinger, R., Correia, C. J., & Irons, J. G. (2012). Relationship between facebook use and problematic Internet use among college students. *Cyberpsychology, Behavior & Social Networking, 15*(6), 324-327.

Ko, C.-H., Hsiao, S., Liu, G.-C., Yen, J.-Y., Yang, M.-J., & Yen, C.-F. (2010). The characteristics of decision making, potential to take risks, and personality of college students with Internet addiction. *Psychiatry Research, 175*(1-2), 121-125.

Ko, C. H., Yen, J. Y., Liu, S. C., Huang, C. F., & Yen, C. F. (2009). The associations between aggressive behaviors and Internet addiction and online activities in adolescents. *Journal of Adolescent Health, 44*(6), 598-605.

Kubey, R. W., Lavin, M. J., & Barrows, J. R. (2001). Internet use and collegiate performance decrements: Early findings. *Journal of Communication, 51*(2), 366-382.

Kukar-Kinney, M., Ridgway, N. M., & Monroe, K. B. (2009). The relationship between consumers' tendencies to buy compulsively and their motivations to shop and buy on the Internet. *Journal of Retailing, 85*(3), 298-307.

Kuss, D. J. (2012). Substance and behavioral addictions: Beyond dependence. *Addiction Research & Therapy*, S6.

Kuss, D. J., & Griffiths, M. D. (2011). Online social networking and addiction - A review of the psychological literature. *International Journal of Environmental Research and Public Health, 8*(9), 3528-3552.

Kuss, D. J., & Griffiths, M. D. (2012a). Internet and gaming addiction: A systematic literature review of neuroimaging studies. *Brain Sciences, 2*, 347-374.

Kuss, D. J., & Griffiths, M. D. (2012b). Internet gaming addiction: A systematic review of empirical research. *International Journal of Mental Health and Addiction, 10*(2), 278-296.

Kuss, D. J., & Griffiths, M. D. (2012c). Online gaming addiction in children and adolescents: A review of empirical research. *Journal of Behavioral Addictions, 1*(1), 1-20.

Lanthier, R. P., & Windham, R. C. (2004). Internet use and college adjustment: The moderating role of gender. *Computers in Human Behavior, 20*, 591-606.

Leung, L. (2004). Net-generation attributes and seductive properties of the Internet as predictors of online activities and Internet addiction. *CyberPsychology & Behavior, 7*(3), 333-348.

Leung, L., & Lee, P. S. N. (2012). The influences of information literacy, internet addiction and parenting styles on internet risks. *New Media & Society, 14*(1), 117-136.

Lićwinko, J., Krajewska-Kułak, E., & Łukaszuk, C. (2011). Internet addiction among academic youth in Białystok. *Progress in Health Sciences, 1*(1), 124-130.

Lin, M.-P., Ko, H.-C., & Wu, J. Y.-W. (2011). Prevalence and psychosocial risk factors associated with Internet addiction in a nationally representative sample of college students in Taiwan. *Cyberpsychology, Behavior and Social Networking, 14*(12), 741-746.

Mantovani, F. (2001). Cyber-attraction: The emergence of computer-mediated communication in the development of interpersonal relationships. In L. Anolli, R. Ciceri & G. Riva (Eds.), *Say not to say: New perspectives on miscommunication* (pp. 236-250). Amsterdam: IOS.

McClernon, F. J., Hiott, F. B., Westman, E. C., Rose, J. E., & Levin, E. D. (2006). Transdermal nicotine attenuates depression symptoms in nonsmokers: A double-blind, placebo-controlled trial. *Psychopharmacology, 189*(1), 125-133.

Mehdizadeh, S. (2010). Self-presentation 2.0: Narcissism and self-esteem on facebook. *Cyberpsychology, Behavior and Social Networking, 13*(4), 357-364.

Mehroof, M., & Griffiths, M. D. (2010a). Online gaming addiction: The role of sensation seeking, self-control, neuroticism, aggression, state anxiety, and trait anxiety. *Cyberpsychology & Behavior, 13*, 313-316.

Mehroof, M., & Griffiths, M. D. (2010b). Online gaming addiction: The role of sensation seeking, self-control, neuroticism, aggression, state anxiety, and trait anxiety. *CyberPsychology & Behavior, 13*(3), 313-316.

Moore, D. (1995). *The Emperor's virtual clothes: The naked truth about the internet culture*. Chapel Hill, North California: Alogonquin.

Morgan, C., & Cotten, S. (2003). The relationship between Internet activities and depressive symptoms in a sample of college freshmen. *CyberPsychology & Behavior, 6*(2), 133-142.

Morrow, P. R. (2006). Telling about problems and giving advice in an Internet discussion forum: Some discourse features. *Discourse Studies, 8*(4), 531-548.

Müller, K. W., & Wölfling, K. (2011). Computer game and Internet addiction: Aspects of diagnostics, phenomenology, pathogenesis, and therapeutic intervention. *Suchttherapie, 12*(2), 57-63.

Niemz, K., Griffiths, M., & Banyard, P. (2005). Prevalence of pathological Internet use among university students and correlations with self-esteem, the general health questionnaire (GHQ), and disinhibition. *CyberPsychology & Behavior, 8*(6), 562-570.

Peters, C. S., & Malesky, L. A. (2008). Problematic usage among highly-engaged players of massively multiplayer online role playing games. *CyberPsychology & Behavior, 11*(4), 480-483.

Poli, R., & Agrimi, E. (2012). Internet addiction disorder: Prevalence in an Italian student population. *Nordic Journal of Psychiatry, 66*(1), 55-59.

Porter, G., Starcevic, V., Berle, D., & Fenech, P. (2010). Recognizing problem video game use. *Australian and New Zealand Journal of Psychiatry, 44*(2), 120-128.

Ross, C., Orr, E. S., Sisic, M., Arseneault, J. M., Simmering, M. G., & Orr, R. R. (2009). Personality and motivations associated with Facebook use. *Computers in Human Behavior, 25*(2), 578-586.

Sheer, V. C. (2010). Hong Kong adolescents' use of MSN vs. ICQ for developing friendships online: Considering media richness and presentational control. *Chinese Journal of Communication, 3*(2), 223-240.

Simkova, B., & Cincera, J. (2004). Internet addiction disorder and chatting in the Czech Republic. *CyberPsychology & Behavior, 7*(5), 536-539.

Smithson, J., Sharkey, S., Hewis, E., Jones, R., Emmens, T., Ford, T., et al. (2011). Problem presentation and responses on an online forum for young people who self-harm. *Discourse Studies, 13*(4), 487-501.

Terracciano, A., Löckenhoff, C. E., Crum, R. M., Bienvenu, O. J., & Costa, P. T. (2008). Five-Factor Model personality profiles of drug users. *BMC Psychiatry, 8*(22).

Tsai, H. F., Cheng, S. H., Yeh, T. L., Shih, C. C., Chen, K. C., & Yang, Y. C. (2009). The risk factors of Internet addiction - A survey of university freshmen. *Psychiatry Research, 167*(3), 294-299.

van der Aa, N., Overbeek, G., Engels, R. C. M. E., Scholte, R. H. J., Meerkerk, G.-J., & Van den Eijnden, R. J. J. M. (2009). Daily and compulsive Internet use and well-being in adolescence: A diathesis-stress model based on Big Five personality traits. *Journal of Youth and Adolescence, 38*, 765-776.

Veen, W., & Vrakking, B. (2006). *Homo zappiens: Growing up in a digital age*. London: Network Continuum Education.

Wellman, B. (1996). An electronic group is virtually a social network. In S. Kiesler (Ed.), *Research milestones on the information highway*. Hillsdale, NJ: Lawrence Erlbaum.

Wellman, B., & Gulia, M. (1999). Net sufers don't ride alone: Virtual communities as communities. In P. Kollock & M. Smith (Eds.), *Communities and cyberspace*. New York: Routledge.

Welz, T., Lynch, S., Nathan, B., Lockyer, S., Adegbite, K., Clift, P., et al. (2011). Ch@tspace - A novel patient internet forum for users of a large, multi-ethnic HIV clinic. *HIV Medicine, 12*, 58-58.

Whitty, M. T. (2002). Liar, liar! An examination of how open, supportive and honest people are in chat rooms. *Computers in Human Behavior, 18*(4), 343-352.

Widyanto, L., & Griffiths, M. (2006). "Internet addiction": A critical review. *International Journal of Mental Health and Addiction, 4*, 31-51.

Wölfling, K., Müller, K., & Beutel, M. (2010). Diagnostic measures: Scale for the Assessment of Internet and Computer Game Addiction (AICA-S). In D. Mücken, A. Teske, F. Rehbein & B. te Wildt (Eds.), *Prevention, diagnostics, and therapy of computer game addiction* (pp. 212-215). Lengerich: Pabst Science.

Wölfling, K., Müller, K. W., & Beutel, M. E. (2011). Reliability and validity of the Scale for the Assessment of Pathological Computer Gaming (CSV-S). *Psychotherapie, Psychosomatik, Medizinische Psychologie, 61*, 216-224.

Xiuqin, H., Huimin, Z., Mengchen, L., Jinan, W., Ying, Z., & Ran, T. (2010). Mental Health, Personality, and Parental Rearing Styles of Adolescents with Internet Addiction Disorder. *Cyberpsychology, Behavior and Social Networking, 13*(4), 401-406.

Young, K. (1998). *Caught in the net*. New York: Wiley.

Young, K. (2010). Internet addiction over the decade: A personal look back. *World Psychiatry, 9*(2), 91-91.

Young, K. S. (2004). Internet addiction - A new clinical phenomenon and its consequences. *American Behavioral Scientist, 48*(4), 402-415.

Yuen, C. N., & Lavin, M. J. (2004). Internet dependence in the collegiate population: The role of shyness. *CyberPsychology & Behavior, 7*(4), 379-383.

Zimbardo, P. G. (1969). The human choice: Individuation, reason, and order vs. deindividuation, impulse, and chaos. In W. J. Arnold & D. Levine (Eds.), *Nebraska Symposium on Motivation*. Lincoln, NE: University of Nebraska.

Zuckerman, M. (2002). Zuckerman-Kuhlman Personality Questionnaire (ZKPQ): An alternative five-factorial model. In B. De Raad & M. Perugini (Eds.), *Big Five Assessment* (pp. 377-396). Seattle, WA: Hogrefe and Huber.

Zywica, J., & Danowski, J. (2008). The faces of Facebookers: Investigating social enhancement and social compensation hypotheses: Predicting Facebook and offline popularity from sociability and self-esteem, and mapping the meanings of popularity with semantic networks. *Journal of Computer-Mediated Communication, 14*(1), 1-34.