Original Papers

Katarzyna Kaliszewska-Czeremska*

Modelling Excessive Internet Use:s
Revision of R. Davis's Cognitive-Behavioural Model of Pathological Internet Use

This article proposes a new model of excessive Internet use. The point of departure for the present study was the Cognitive-Behavioural Model of Pathological Internet Use developed by R. Davis (2001). The original model was modified so as to improve its explanatory power. Data were collected from 405 participants aged from 18 to 55 in various Polish towns and cities. The following instruments were administered to the participants: The Temperament and Character Inventory, J. Kuhl's Action Control Scale, The Berlin Social Support Scale, The Coping Inventory for Stressful Situations, The Excessive Internet Use Risk Scale, The Reasons for Internet Use and the Personal Data Questionnaire. The new model of excessive Internet use was empirically tested and proved to be satisfactory.

Introduction

As the Internet becomes increasingly popular, more and more questions are being asked concerning its advantages and risks and the new bio-psycho-social problems relating to human functioning in the specific environment called virtual space (cyberspace). Existing research has demonstrated that the majority of Internet users use the resources and applications of this medium functionally (Davis, 2001; Hills & Argyle, 2003; Kraut et al., 1998; Morahan-Martin & Schumacher, 2000, 2003; Weiser, 2001). It has also been demonstrated, however, that a number of users lose control over the amount of time spent online and the way they use the Internet. The web is often the basic place of functioning for these users but the negative consequences of excessive use of the Internet are far from virtual. They are very real-world. In the literature this way of using the Internet has been called dysfunctional (Weiser, op. cit.; Morahan-Martin & Schumacher, 2000, 2003), maladaptive (Beard & Wolf, 2001), pathological/excessive[1] (Davis, op. cit.; Weinstein & Lejoyeux, 2010), or problematic (Shapira et al., 2000, 2003). From 6 to 14 percent of all Internet

users worldwide may have a problem of excessive Internet use (DeAngelis, 2000; quoted after Shapira et al., 2003; cf. Byun et al., 2009; Tao et al., 2010; Weinstein & Lejoyeux, op. cit.).

Very little is still known about excessive Internet use. Researchers have only recently begun to study the problem intensively and those who do have still to reach consensus as to its nature (cf. Shapira et al., 2003; Byun et al., op. cit.). A review of existing theoretical and/or empirical work on excessive Internet use suggests that most of the investigation has been atheoretical. Researchers have mainly striven to identify the symptoms, often per analogy to substance abuse or pathological gambling (cf. Goldberg, 1995; Griffiths, 1998, 2000; Tao et al., op. cit.; Young, 1996). They have failed to offer theoretical explanations of the origins and pathogenesis of excessive Internet use. The Cognitive-Behavioural Model of Pathological Internet Use proposed by R. Davis is an attempt to break away from this practice (Davis, 2001; Davis et al., 2002; cf. Caplan, 2002, 2010; Kaliszewska, 2007a). Davis's model (2001) explains the origin and pathogenesis of pathological Internet use in cognitive-behavioural terms. It is therefore a good point of departure for further research on the problem. The basic assumption of Davis's model served as the theoretical starting point for the present study.

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[1] The term the present author has chosen to signify the phenomenon under study is semantically closer to the term pathological (meaning „pathic" from the Greek *pathikos* and its derivative *pathos*) and will be used in this sense throughout the article.

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*   **Institute of Psychology, Adam Mickiewicz University, ul. Szamarzewskiego 89, 60-578 Poznań, Poland**
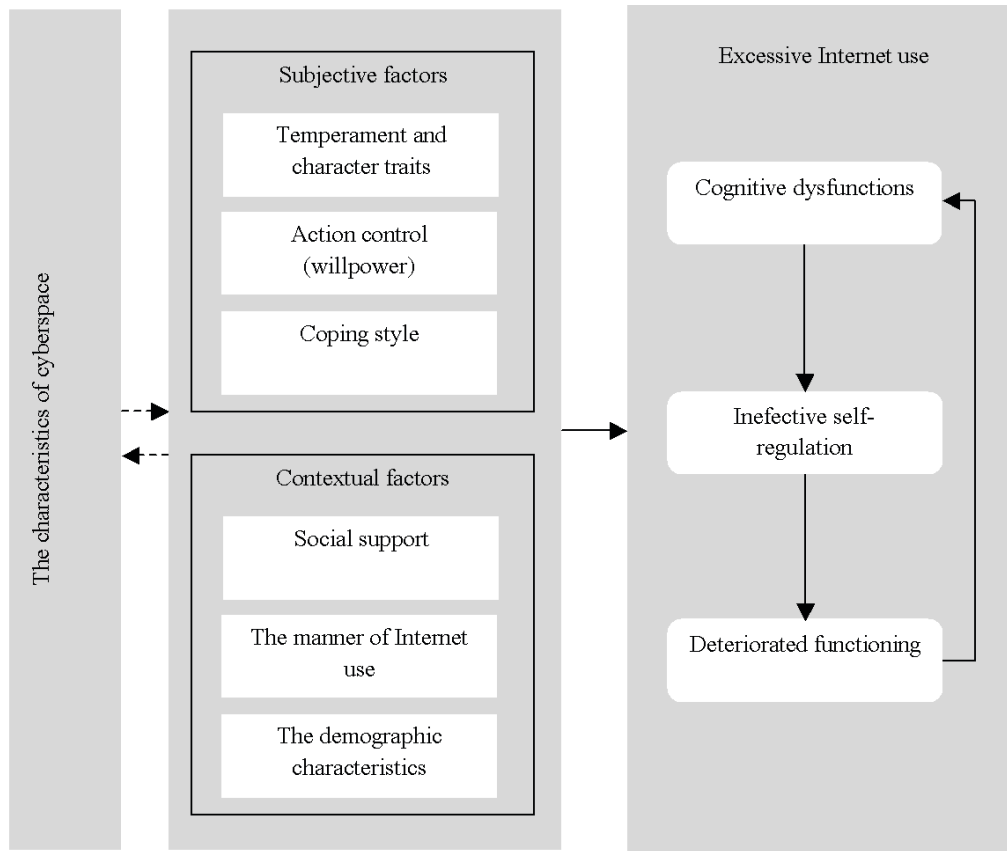
Figure 1. Model of the structure of variables and relations between them.

Note. Cyberspace characteristics were not studied (as indicated in the model by the dotted line).

Theoretical framework

The main objective of this study was to construct a model of excessive Internet use. Construction of the model, which was to be submitted to empirical testing, was advised by the theoretical assumptions of R. Davis's (2001) Cognitive-Behavioural Model of Pathological Internet Use (cf. Kaliszewska, 2007a). Although Davis's original model was modified, its original general assumptions were retained. The modifications were introduced so as to increase the original model's explanatory power. The present study was conducted on the assumption that the studied phenomenon is multidimensional and its development is processual. It was also decided that excessive Internet use would be understood in the general terms of disturbed impulse (habit and drive) control (Shapira et al., 2003). The tested structure of variables and linking relations is presented schematically in Figure 1.

The diagnostic criteria for excessive Internet use

The diagnostic criteria for excessive Internet use which were adopted in the present study are based on both Davis's (op. cit.) approach to the phenomenon and to the criteria proposed by Shapira and collaborators (op. cit.). For the purpose of the present study, excessive Internet use was defined as "a dysfunctional pattern of cognitive and behavioural elements relating to one's Internet use and resulting in loss of control over one's behaviour and significant deterioration of one's social functioning, occupational functioning or functioning in another significant area". Note that this construct definition has several elements at the operational level.

The first element is the dysfunctional pattern of cognitive-behavioural elements relating to Internet use. According to the theoretical assumptions, two things are involved here. First, excessive Internet users have cognitive dysfunctions in the form of negative beliefs about themselves, their environment and their self-environment relations (cf. Davis, 2001). Second, excessive Internet users have ineffective self-regulation, i.e., they use the Internet to delay task completion and/or regulate mood (Davis, Flett & Besser, 2002). In the present study the latter elements are viewed in a broader theoretical context, i.e., in terms of ineffective self-regulation (action control) (cf. Baumeister et al., 2000).

The next element in the above definition is deterioration of the user's social functioning, occupational functioning or functioning in another significant area. This also applies to the negative consequences of Internet use which have been widely discussed in the literature (Amichai-Hamburger &

Ben-Artzi, 2003; Caplan, 2002; Davis, 2001; Davis et al., 2002; Kraut, 1998; Morahan-Martin & Schumacher, 2000, 2003; Suler, 1996, 1999; Young, 1996).

The last element of the above definition is the processual development of excessive Internet use. Bearing in mind the assumptions of Davis's (2001) model, the present author assumed that cognitive elements of the user's functioning, are a key factor in the development and persistence of the phenomenon under study. According to the model's theoretical assumptions, the presence of cognitive dysfunctions is a sufficient determinant of the presence of symptoms of pathological Internet use. The presence of such symptoms, in turn, feeds back into the emergence of cognitive dysfunctions. Together with the present theoretical assumptions, these original assumptions allowed the author to formulate several hypotheses concerning causal relations between the presence of cognitive dysfunctions on the one hand and ineffective self-regulation and the negative consequences of Internet use on the other hand. It was also hypothesized that a feedback loop would exist between negative consequences of excessive Internet use and the presence of cognitive dysfunctions in excessive users.

Research problem 1: Is excessive Internet use a processual phenomenon?

Temperament and character traits and the development of excessive Internet use

The proposed modifications of Davis's (2001) model involved the inclusion of additional, explanatory theoretical constructs. The most poorly understood element of Davis's (op. cit.) model is the so-called susceptibility factor. The role of this factor in the development and persistence of the phenomenon under study has been very scantily explained, giving rise to many doubts. According to the present author, both types of pathological Internet use are rooted, among other things, in a psychopathological disorder factor. This factor is viewed as a susceptibility factor – it is distal, necessary and accelerates the development of the phenomenon although it is not sufficient for symptoms to emerge. Due to the uncertainties it raised, Davis's (op. cit.) original theoretical model was modified. In the present model, the susceptibility factor was treated as a personality (temperament and character) trait according to R. Cloninger (1994a, 1994b, 1997). It is noteworthy that Davis (2001) also mentions the need to include personality dispositions in the model and points out that they may help to explain the mechanism of development of distinct types of pathological Internet use. Other researchers before Davis also tried to identify the personality determinants of excessive Internet use (cf. Amichai-Hamburger & Ben-Artzi, 2000, 2003; Cho et al., 2008; Hills & Argyle, 2003; Ko et al., 2006; Kraut et al., 1998, 2002; Lee at al., 2009; Lin & Tsai, 2002; Mottram & Fleming, 2009; Swickert et al., 2002; Velezmoro, Lacefield & Roberti, 2010; Weinstein & Lejoyeux, 2010).

Research problem 2: Do excessive Internet users have a specific configuration of temperament and character traits?

Excessive Internet use, action control and coping style

In the present attempt to identify the factors which predispose people to use the Internet excessively, including theoretical concepts which could help to explain the role of task delay and use of inadequate ways of coping with emotional tension, two more theoretical concepts were included in the model. First, the original model was enlarged by J. Kuhl's (1994a) willpower (action control) construct. The suggestion of Davis et al. (2002) was also retained but expanded to include stress understood in terms of coping style (Endler & Parker, 1990, 1994). When modifying the model, it was presumed that both task delay and inadequate coping style (cf. Ratajczak, 1996) may be related to a broader theoretical construct, ineffective self-regulation (action control) (cf. Caplan, 2010; Baumeister et al., 2000; Sęk, 2001).

Research problem 3: Is excessive Internet use related to action control and coping style?

The role of social support in the development and persistence of excessive Internet use

The concept of social support, already included in Davis's model, was also included in the present model, albeit in a different theoretical context. In Davis's model, Internet users' real social isolation and/or lack of social support are viewed as factors significantly related to generalized pathological Internet use. However, the existing empirical research in which the social context of Internet use was considered is inconclusive as far as the role this factor plays in the development and persistence of excessive Internet use is concerned (cf. Amichai-Hamburger & Ben-Artzi, 2003; Caplan, 2002; Davis et al., 2002; Kraut et al., 1998, 2002; Morahan-Martin & Schumacher, 2000, 2003; Shapira et al., 2003; Swickert et al., 2002; Weiser, 2001). Knowing how extensive an effect social support has on the style and quality of human functioning, and considering the existing work on excessive Internet use, the present author decided to include the social support construct in her study. Taking into consideration the specific nature of the present study, it was decided that N. Knoll and R. Schwarzer's conceptualization of the social support construct (2004: 30) would be adopted in the proposed model.

Research problem 4: What role does social support play in the development and persistence of excessive Internet use?

The role of contextual variables (demographic variables and way of using the Internet) in the development of excessive Internet use

The model includes variables which provide the context for Internet users' functioning. These are typical

demographic variables and specific environmental variables (i.e. experience). The model also includes ways of using the Internet. According to Davis, taking advantage of the Internet's various resources and possibilities is associated with the development of distinct use subtypes. Taking the existing research findings as a point of departure (Davis, 2001; Suler, 1996, 1999; Wallace, 2001), it was hypothesized that the way the Internet is used is related to the development of excessive use. The purpose of the present study was to construct a general model of excessive Internet use, without indicating the separate developmental pathways leading to its subtypes (cf. Caplan, 2007, 2010). Therefore, two groups of Internet resources and possibilities were included in the model: dysfunctional ones (the ones which Davis associated with the development of both types of the phenomenon); functional ones (associated with practical, purposeful Internet use) (cf. Table 1).

Several cyberspace characteristics also provided the research context. They were not the object of investigation, however. They are included in the model so as to highlight the specific nature of the environment in which Internet users function.

Research problem 5: What role do contextual variables (demographic variables and ways of Internet use) play in the development of excessive Internet use?

Taking into consideration the adopted theoretical assumptions, the following hypotheses (i.e. 1-3) and research questions (i.e. 4-5) were formulated concerning:

1. the processual nature of excessive Internet use (Davis, 2001). It was predicted that causal relations would be found between the defining dimensions of excessive Internet use, i.e., presence of cognitive dysfunctions, ineffective self-regulation and deteriorated functioning in Internet users. A feedback loop was also hypothesized to exist between the deteriorated functioning of excessive Internet users and cognitive dysfunctions.

2. the personality determinants of excessive Internet use. It was hypothesized that excessive Internet users would have a specific configuration of temperament and character traits (Cloninger, 1994a, 1994b, 1997). Also, bearing in mind the existing findings of studies in which the personality construct was included in the theoretical assumptions, it was hypothesized that personality traits would moderate the style of Internet resource and application utilization. A relationship was also consequently predicted between the specific configuration of personality traits and negative effects of excessive Internet use.

3. the relationship between Internet use and ineffective action control (Kuhl, 1994a) and coping style (Endler & Parker, 1990; 1994). Taking into consideration the existing findings on style of functioning in excessive Internet users, including their tendency to delay tasks and adopt inadequate coping styles to reduce

emotional tension, a relationship was hypothesized between ineffective self-regulation (action control) and excessive Internet use (cf. Baumeister et al., 2000; Sęk, 2001).

4. the relationship between excessive Internet use and deficient social support (Davis, op. cit.). Due to the unclear role of social support in the development and persistence of the phenomenon under study, the social support construct was broadly conceived, i.e., N. Knoll and R. Schwarzer's definition (2004: 30) was adopted.

5. the role of contextual variables (demographic variables and way of using the Internet) in the development of excessive Internet use.

Method

Design and participants

The number of Internet users in Poland has nearly doubled within the last 5 years. At present, nearly 48% of Poles declare Internet use. The average age of adult users (over 18) is 35. Men use the Internet slightly more frequently than women (51% and 49% respectively) and use is more frequent among younger (age 18-24 – 86%, 25-34 – 68%, 35-44 – 61%, 45-54 – 47%, 55-54 – 25%, 55-64 – 25%, 65+.– 7%), more educated (primary 21%, vocational 35%, secondary 62%, college and university 88%) users and users living in medium sized towns and cities (village 39%, towns from 20-100 thousand inhabitants 50%, cities over 100 thousand inhabitants – nearly 60%) (CBOS, 2010). Existing findings suggest that from 2 to 6% of Polish Internet users may be using excessively (Augustynek, 2001; Kaliszewska, 2007a; Poprawa, 2007).

The present study was exploratory. There were two criteria of sample selection, i.e., age (over 18) and declared Internet use. Each participant was studied individually, off-line and participation was voluntary and anonymous. The study was run on 405 participants (211 women – 52.1% and 194 men – 47.9%) aged from 18 to 55 (M = 25.37, SD = 7.07). The study was conducted on secondary school pupils in various Polish towns and cities (Gdańsk, Gdynia, Poznań, Nowa Sól, Leszno), students of vocational colleges in Poznań, students studying in large academic centres (Poznań, Kraków), employees working in public institutions and private firms (Warsaw, Gdańsk, Gdynia, Sopot, Wrocław, Poznań, Kraków).

The sample was heterogeneous as far as declared level of education is concerned – 12.6% primary, 59% secondary and 28.1% higher; 65% of the sample were studying at the time of the study. The largest portion of respondents (58.8%) lived in large cities (over 200 thousand inhabitants), 20.7% lived in towns with fewer than 100 thousand inhabitants, 13.6% lived in villages, and 6.9% lived in cities with between 100 and 200 thousand inhabitants.

Table 1
Research instrument characteristics.

Measure	Scales (and subscales)	M	SD	r_{tt}
SNUI	Cognitive dysfunctions	5.49	8.63	$\alpha = 0.94$
	Ineffective self-regulation	19.53	10.42	$\alpha = 0.87$
	Deteriorated functioning	3.58	4.39	$\alpha = 0.81$
	Total SNUI score	28.60	20.16	$\alpha = 0.94$
TCI	Temperament traits			
	Novelty seeking (Exploratory Excitability, Impulsiveness, Extravagance, Disorderliness)	21.24	6.24	$KR_{20} = 0.79$
	Harm avoidance (Anticipatory Worry, Fear of Uncertainty, Shyness, Fatigability)	15.59	7.03	$KR_{20} = 0.87$
	Reward dependence (Sentimentality, Attachment, Dependence)	14.13	3.59	$KR_{20} = 0.65$
	Persistence	4.09	1.82	$KR_{20} = 0.50$
	Character traits			
	Self-directedness (Responsibility, Purposefulness, Resourcefulness, Self-acceptance, Congruent second-nature)	26.14	7.47	$KR_{20} = 0.85$
	Cooperativeness (Social Acceptance, Empathy, Helpfulness, Compassion, Pure-heartedness)	30.16	6.52	$KR_{20} = 0.85$
	Self-transcendence (Self-forgetfulness, Transpersonal identification, Spiritual acceptance)	15.67	6.23	$KR_{20} = 0.84$
ACS-90	Failure-related action vs. preoccupation	3.84	2.90	$KR_{20} = 0.79$
	Decision-related orientation vs. hesitation	6.07	3.00	$KR_{20} = 0.77$
	Performance-related action vs. volatility	8.85	2.46	$KR_{20} = 0.69$
BSSS	Perceived available support	3.35	0.59	$\alpha = 0.90$
	Need for support	2.71	0.75	$\alpha = 0.71$
	Support seeking	2.63	0.68	$\alpha = 0.80$
	Actually received support	2.81	0.60	$\alpha = 0.90$
	Protective buffering support	2.32	0.67	$\alpha = 0.80$
CISS	Task oriented coping	57.50	7.93	$\alpha = 0.86$
	Emotion oriented coping	48.47	8.69	$\alpha = 0.82$
	Avoidance coping (Distraction, Social diversion)	46.19	8.15	$\alpha = 0.75$
KDO	Demographic variables: age, sex, place of residence, time and place of Internet use, Internet experience.			
SPKI	Ways of Internet use by groups of resources and possibilities: a) dysfunctional (i.e. browsing, partner seeking, pornography use, gambling); b) functional (i.e. work, study, e-services).			

Measures

Participants were requested to complete the following questionnaire battery (cf. Table 1):

a) The Excessive Internet Use Risk Scale (SNUI) (Kaliszewska, 2007). The SNUI was specially constructed for the purpose of the present study. The scale's theoretical rationale is an integral part of the new model of excessive Internet use (cf. Figure 1).

b) The Temperament and Character Inventory (TCI), Polish adaptation (Hauser et al., 2003), an operationalization of R. Cloninger's personality model (1994a, 1994b, 1997).

c) The Action Control Scale (ACS-90), Polish adaptation (Marszał-Wiśniewska, 2002), which assesses action control (willpower) according to J. Kuhl (1994a, 1994b).

d) The Berlin Social Support Scales (BSSS), Polish adaptation (Łuszczyńska et al., 2005, 2006), which assesses the cognitive and behavioural dimensions of social support (Schwarzer & Schulz, 2000).

e) The Coping Inventory for Stressful Situations (CISS), Polish adaptation (Strelau at al., 2005), which assesses coping style (Endler & Parker, 1990).

f) The Reasons for Internet Use (SPKI) and the Personal Data Questionnaire (KDO), which assess ways of Internet use (SPKI) and demographic variables (KDO).

Data analysis

The data were analyzed with the help of SPSS 17.0 and LISREL 8.51 (Jöreskog & Sörbom, 1996). The main goal of the present study was to generate a picture

Table 2
Results of multiple regression analysis of the independent variables included in the model of excessive Internet use.

Variables	B	β	t
Dysfunctional resources and Internet applications	1.22	0.51	15.23***
Self-forgetful	0.10	0.18	4.42***
Resourcefulness	-0.13	-0.15	-3.45***
Persistence	-0.08	-0.11	-2.87***
Shyness	0.07	0.12	3.03***
Sentimentality	-0.06	-0.10	-2.53**
Performance-related action orientation vs. volatility	-0.05	-0.09	-2.44**
Functional Internet resources and applications	0.18	0.08	2.27*

Note. $N = 405$; *** $p < 0.001$; ** $p \leq 0.01$; * $p < 0.05$. $R = 0.69$; $R^2 = 0.48$; adjusted $R^2 = 0.47$; $F(8, 386) = 44.86$; $p < 0.001$. The table shows the values of unstandardized (B) and standardized (β) regression coefficients.

of the phenomenon of excessive Internet use. To reach this goal it was necessary to identify the determinants and modifiers of the development and persistence of excessive Internet use and their interrelations. The relations between the variables in the proposed model were analyzed step by step. Due to limited space, this article only presents the final step of the data analysis. This step involved: generation of predictors of excessive Internet use (using multiple regression analysis), and generation and testing of the proposed model of excessive Internet use (using path analysis).

Results

Predictors of excessive Internet use

In order to obtain a comprehensive picture of the relations between the independent variables in the proposed model of excessive Internet use (temperament and character traits, action control, social support, coping style, style of Internet use and selected demographic variables) and excessive Internet use (global score), a final (stepwise) multiple regression analysis for excessive Internet use was conducted. The model is presented in Table 2.

The following significant predictors of excessive Internet use were obtained (in order of significance): a) style of Internet use, and specifically use of dysfunctional resources and applications; b) character traits, and specifically self-transcendence, i.e., self-forgetfulness and self-direction, i.e., resourcefulness; c) temperament traits, i.e., persistence, shyness (sub-dimension: harm avoidance), sentimentality (sub-dimension: reward dependence); d) ineffective action control (volitional), i.e., change-orientation during action execution and e) use of functional Internet resources and applications. Together these predictors account for 48% of the variance of the dependent variable ($R^2 = 0.48$, adjusted $R^2 = 0.47$), i.e., excessive Internet use. This solution is justified: $F(8, 386) = 44.86$ ($p < 0.001$).

The excessive Internet use model

Construction of the excessive Internet use model was a two-step process and its nature was exploratory. Partial models were generated in step one and the conclusions drawn from the emergent solutions were used to construct a global model of the phenomenon under study. Successive partial models served to generate the final model, not to test the theoretical assumptions. The first seven generated and tested partial models were used to determine the relations between excessive Internet use on the one hand and temperament and character traits on the other hand. The next two models were constructed to determine the relations between excessive Internet use and coping style. The purpose of the last two models was to determine the relations between social support and volitional action control. The partial solutions were obtained by freeing all the paths which did not meet the criterion of statistical significance ($p < 0.01$). All the models were constructed so that their goodness of fit indices were satisfactory, i.e., the value of the χ^2 test was not statistically significant, the value of the RMSEA index did not exceed 0.05 and the values of the GF and AGF indices were not lower than 0.90. Since full presentation of the process of generation of the model of the phenomenon under study would exceed the confines of this text, only the final model can be presented.

Initiation of the global model construction process was informed by the conclusions drawn from the analyses of partial model construction and the analyses of earlier stages of this work. It was therefore possible to include only selected independent variables in the proposed model. The following exogenic variables were included: style of Internet use (use of functional and/or dysfunctional Internet resources and applications), temperament traits (novelty seeking, persistence), character traits (self-directedness, cooperativeness, self-transcendence), action control (action orientation vs. state orientation in decisional situations), avoidant coping style (engagement in substitute activities and social contact seeking), and currently received social support. As far as endogenic variables are concerned, three dimensions of excessive Internet use were
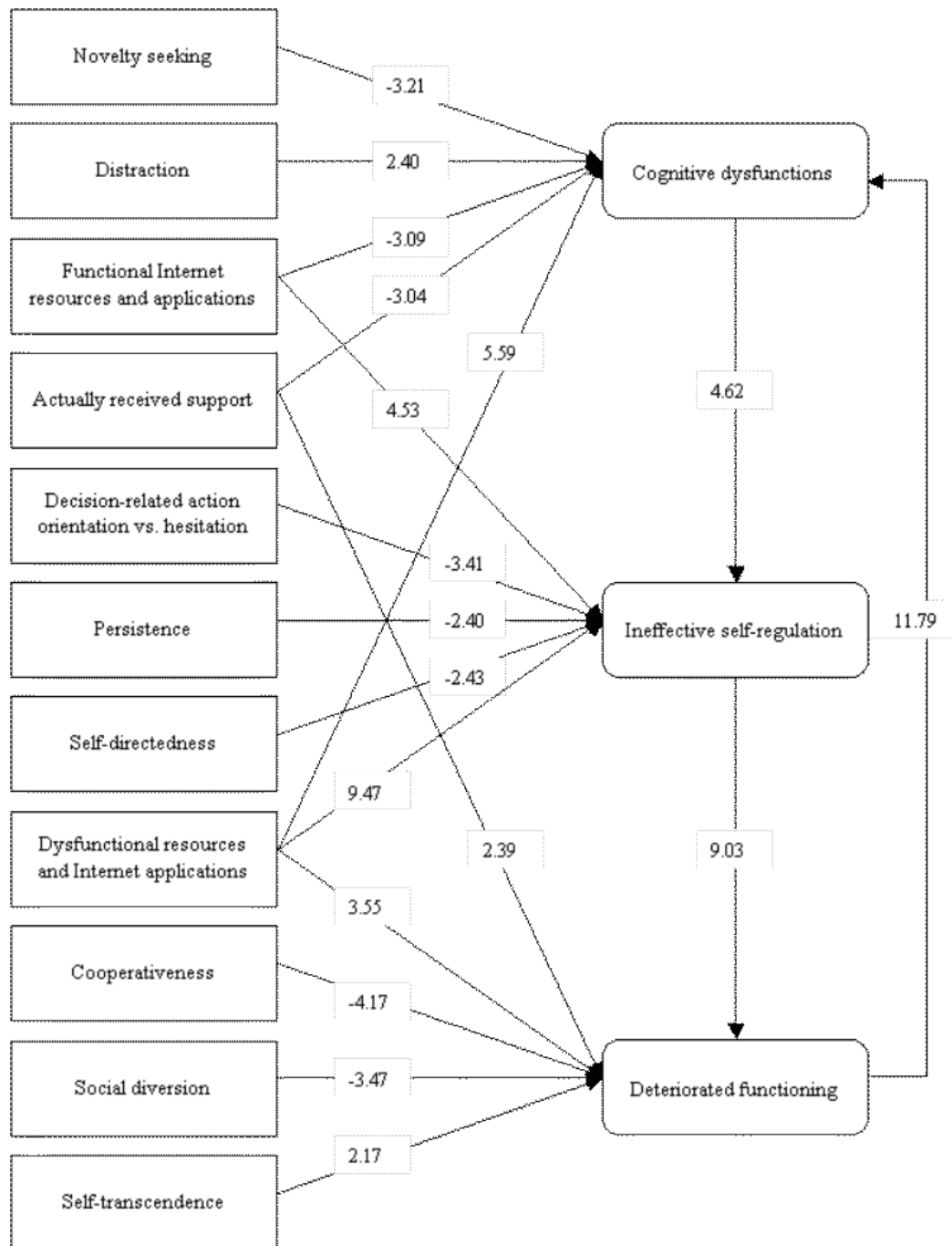
Figure 1. Tested model of excessive Internet use.

Note. N = 405; $\chi2$ = 15.28 (df = 18, p = 0.64), RMSEA ≤ 0.01, GFI = 0.99, AGFI = 0.97.

included in the model: cognitive dysfunction, ineffective self-regulation and deteriorated functioning due to Internet use. The existence of causal relations between cognitive dysfunction, ineffective self-regulation and deteriorated functioning in excessive Internet users was also assumed when constructing the model. It was additionally assumed that deteriorated functioning in excessive Internet users would feed back into cognitive dysfunction. Figure 2 gives a graphic presentation of the generated model and the identified parameters.

According to the adopted criteria, the goodness of fit for the proposed model, i.e., $\chi^2 = $ 15.28 (df = 18, p = 0.64), RMSEA ≤ 0.01, GFI = 0.99, AGFI = 0.97), is satisfactory.

As predicted, when the model was tested, causal relations were found between the defining dimensions of excessive Internet use, i.e., cognitive dysfunction, ineffective self-regulation and deteriorated functioning. A feedback loop was also found between deteriorated functioning in

excessive Internet users and cognitive dysfunction.

The analysis also revealed that cognitive dysfunction increased in direct proportion to engagement in substitute activity and use of dysfunctional Internet resources and applications ($p < 0.01$). The presence of cognitive dysfunction was inversely related ($p < 0.01$) to novelty seeking, use of functional Internet resources and applications, and currently received social support.

The portrait of excessive Internet users which has emerged so far was additionally fine-tuned when the second defining dimension of excessive Internet use, i.e., engagement in behaviours indicative of ineffective self-regulation, was analyzed. Ineffective self-regulation was inversely related ($p < 0.01$) to self-direction, persistence and action orientation in decisional situations. Use of both functional and dysfunctional Internet resources and applications was directly related to ineffective self-regulation.

Cognitive dysfunction and behaviours indicative of ineffective self-regulation lead to deterioration of the real-life functioning of Internet users. This study demonstrated that deteriorated functioning is inversely related ($p < 0.01$) to cooperativeness and seeking real social contact when under stress. Direct relations ($p < 0.01$), on the other hand, were found between approach to currently received social support, self-transcendence and use of dysfunctional Internet resources and applications.

Once the model was verified it was possible to obtain a global picture of the psychological traits which characterize excessive Internet users. The following portrait emerged from the analysis: a) low need of stimulation, cognitive rigidity and low stress resistance; b) low persistence, low self-directedness, ineffective action control expressed in state orientation in decisional situations; c) use of avoidant coping styles when under stress such as engagement in substitute activities; d) low cooperativeness combined with social incompetence and real loneliness; e) failure to seek social contact when under stress; f) low real (actually received) social support; g) high self-transcendence combined with loss of control over one's time and way of using the Internet; multidimensional use of Internet resources and applications (functional and/or dysfunctional).

Discussion

The basic objective of this research project was to develop a model of excessive Internet use. A number of research hypotheses derived from the model's theoretical assumptions were tested.

The processual nature of excessive Internet use

The present findings confirmed the hypothesized processual nature of excessive Internet use. It was hypothesized that causal relations exist between the various dimensions of excessive Internet use and that there is a feedback loop connecting progressive deterioration of the functioning of excessive Internet users and cognitive dysfunctions. Empirical testing of the model supported the hypotheses. It is worth noting that although Davis's (2001) original model was modified, the mechanism of development of the present study supported the mechanism underlying the phenomenon under study (cf. Figure 2).

Temperament and character traits and the development of excessive Internet use

The present findings demonstrate that selected temperament and character traits are significant predictors of excessive Internet use (cf. Table 2). It is noteworthy that only two character trait sub-dimensions were nonsignificant, i.e., low resourcefulness (a sub-dimension of self-directedness) and high self-forgetfulness (a sub-dimension of self-transcendence). The following temperament traits and temperament trait sub-dimensions were significant predictors of excessive Internet use: low persistence (a temperament trait), high shyness (a sub-dimension of harm avoidance) and low sentimentality (a sub-dimension of reward dependence).

It is also worth noting that, according to Cloninger (1994a, 1994b, 1997) it is a specific configuration of temperament traits (high novelty seeking and high reward dependence) and character traits (low negative reinforcement avoidance and low self-directedness) which predicts addiction susceptibility. The configuration of temperament and character traits obtained in the present study is not unequivocally similar to the typical configuration for substance dependencies described in literature. The portrait of Internet users which emerged from the present study suggests the need for further analysis of the environmental determinants of excessive Internet use. The present study showed that excessive Internet users are poorly socialized or exhibit specific personality immaturity (cf. Hornowska, 2003: 22-23).

Selected temperament and character traits were also included in the present model. Different traits apparently played different roles in consecutive stages of development of the phenomenon under study (cf. Figure 2). Excessive Internet users had two prominent temperament traits, i.e., low novelty seeking and low persistence. They also had the following personality traits postulated by the model: low self-directedness, low cooperativeness and high self-transcendence (cf. Ko et al., 2006; Weinstein & Lejoyeux, 2010: 280). Interestingly, the typical trait configuration for excessive Internet users found in existing studies using the TCI (low cooperativeness and low self-directedness) is also typical of all personality disorders listed in the DSM-III-R (cf. Hornowska, op. cit.). If we combine these findings with the high self-transcendence found in the present study of excessive Internet users, we can formulate the following

hypothesis: loss of control over one's behaviour in Internet users may occur in individuals who have immature or disordered personalities.

The present findings suggest that Internet use per se is not the main source of problems in the studied group. Internet use merely triggers or catalyzes the development of dysfunctional behaviour. Excessive Internet use is catalyzed in individuals who are already predisposed to such problem behaviour. These hypotheses converge with the theoretical assumptions of Davis's (op. cit.) model. They also converge with those theoretical proposals which underscore the role of personality traits in style of functioning in cyberspace (use of Internet resources and applications) and with what is known about the individual consequences of activity (Suler, 1996, 1999). The present findings suggest that it was fortunate that the personality construct was included in the present model because it helped to elucidate the mechanisms of development and persistence of the phenomenon under study. It also seems that this is a promising line of research which will be continued in future theoretical and empirical work on excessive Internet use (cf. Weinstein & Lejoyeux, 2010).

Excessive Internet use, action control and coping style

In the search for factors relating to the development and persistence of excessive Internet use, two additional constructs were included in the theoretical model, willpower (Kuhl, 1994a) and coping style (Endler & Parker, 1990, 1994). In light of existing empirical research and theoretical reflections on excessive Internet use, these two constructs were approached from a broader theoretical perspective, i.e., the effectiveness of self-regulation (cf. Baumeister et al., 2000; Caplan, 2010; Hardie & Tee, 2007; Sęk, 2001). The results were very interesting indeed. None of the coping styles predicted excessive Internet use. Ineffective (volitional) control in the form of change orientation during activity did. However, in the new model of excessive Internet use, both coping style and willpower (action control) were related to the mechanisms of development of excessive Internet use. Both coping style and will power were related to the consecutive stages of development of excessive Internet use. One form of avoidant coping style, engaging in substitute activities, was directly related to the level of observed cognitive dysfunction. The other variant of this coping style, seeking social contact, was inversely related to the level of deterioration in functioning. The findings concerning the role of these constructs suggest the existence of self-regulation deficits in excessive Internet use. It may therefore be concluded that it was a good thing that both constructs were included in the theoretical model. Inclusion of these constructs was more revealing of the phenomenon under study and increased the explanatory power of the model as far as the mechanism of development and persistence of excessive Internet use is concerned.

The role of social support in the development and persistence of excessive Internet use

Another construct which was included in the proposed theoretical model of excessive Internet use is social support (Knoll & Schwarzer, 2004). Social support was not a significant predictor (cf. Table 2) in the present study. It is worth noting that the currently received social support construct did show up in the present model. It is inversely related to the level of observed cognitive dysfunction and directly related to the level of deteriorated functioning. However, the present findings (the unclear role of social support in the development of excessive Internet use) may be the result of the way social support was measured. Self-report measures are perhaps not the best way to measure this variable just as they are not the best way to measure social competencies. It was therefore hypothesized that Internet users may be getting their social support online. This makes it difficult to assess Internet users' real-life social support. Virtual support complicates the picture of real-life support. It is hard to say whether lack of real-life social support is the cause or effect of excessive cyberlife. Findings to date suggest that social support is probably an important factor in the development and persistence of excessive Internet use (cf. Amichai-Hamburger & Ben-Artzi, 2003; Caplan, 2007; Cheung, Chiu & Lee, 2011; Kraut, 1998, 2002; Mitchell et al., 2011; Swickert et al., 2002).

The role of contextual variables in the development of excessive Internet use

According to the present findings, of all the variables which provide the context for Internet users' functioning, only way of Internet use has a significant effect on the development of excessive Internet use. Using dysfunctional vs. functional Internet resources and possibilities emerged both in the tested model and in the list of predictors. Use of dysfunctional resources and possibilities is the most powerful predictor of this phenomenon (cf. Table 2). It also contributes to the phenomenon's development (cf. Figure 2).

Limitations

The present study was exploratory and followed a cross-section design and therefore shares the typical limitations of this kind of research. First and foremost, it was not possible to identify the stages of development of excessive Internet use. To do so, one would have to conduct a longitudinal study and additional qualitative research. The present study does not enable the identification of possible subtypes or additional mechanisms of development of excessive Internet use. Such information would of course be extremely valuable and would provide additional insight into the studied phenomenon. The present model needs to be tested once again because the incidental nature of the

present sample is a serious limitation.

Directions for future research

The present findings suggest that Internet use has many determinants, many of which are maladaptive. The risk of development and persistence of problematic use may be greater in individuals who are susceptible to personality disorders or whose personalities are immature. In the context of the present findings it is probably fair to say that, as far as the mechanisms of development of functional vs. dysfunctional Internet use are concerned, a promising approach would be to base future research on contemporary theories of developmental psychopathology. These theories are currently being successfully used in research on the mechanisms of psychoactive substance dependence. They enable researchers to adopt multifactor designs in the study of development, stabilization and subsiding of maladaptive behaviours. It is necessary to view the explored phenomenon from a broad perspective and to capture the mechanisms of development and persistence of excessive Internet use from a developmental point of view. If these approaches are adopted, future researchers of excessive Internet use may reap a bountiful harvest.

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