Eötvös Loránd University, Faculty of Education and Psychology

THESES OF THE DOCTORAL DISSERTATION

ORSOLYA KIRÁLY

Assessment and psychological mechanisms of problematic online gaming

Doctoral School of Psychology
Head of the School: Prof. Attila Oláh, CSc

Personality and Health Psychology Program
Head of the Program: Prof. Attila Oláh, CSc

Supervisor: Prof. Zsolt Demetrovics, DSc

Committee members:

President: Prof. Rácz József, DSc
Secretary: Dr. Habil. Ágoston Schmelowszky, PhD, associate professor
Opponents: Dr. Adrienn Ujhelyi, PhD, assistant professor
Dr. Attila Körmendi, PhD, associate professor
Members: Prof. Enikő Csilla Kiss, PhD
Dr. Habil. Nguyen Luu Lan Anh, PhD, associate professor
Dr. Mária Hoyer, PhD, associate professor
Dr. Zsolt Unoka, PhD, assistant professor

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1.   Background and aims

During the past two decades as the video game industry has grown to a multibillion industry preceding both Hollywood and the music industry in terms of yearly revenues (Goodkind, 2014), the problematic (i.e., addictive-like) use of video games has become a topic of increasing research interest. The last two decades of research in the field of problematic online gaming (or video game addiction) was fairly fruitful. Hundreds of articles have been published on the topic (e.g., Charlton & Danforth, 2007; Griffiths, 2008; Ng & Wiemer-Hastings, 2005; van Rooij, Schoenmakers, van de Eijnden, & van de Mheen, 2010; Young, 2009) and as a result problematic online gaming was included in the Section 3 of the DSM-5 under the name of Internet gaming disorder (American Psychiatric Association, 2013). However, (as Section 3 also indicates), plenty of questions remain to be answered and plenty of disagreements remain to be settled until it can be decided whether problematic online gaming should be accepted as an official diagnosis or not.

In 2011 when I started my PhD, one of the biggest problems was that there was a huge lack in psychometrically validated measurement instruments. For this reason our research team developed the 18-item Problematic Online Gaming Questionnaire (Demetrovics et al., 2012) using thorough psychometric methods (i.e., a series of exploratory and confirmatory factor analysis on non-overlapping random subsamples originated from the initial sample) during the development process. The item pool was generated by means of a comprehensive literature review and interviews with online gamers. The target group comprised adult online gamers and data collection took place online. To further test the psychometric properties of the POGQ, the instrument was used in another survey (i.e., European School Survey Project on Alcohol and Other Drugs; ESPAD) targeting a different population (i.e., national sample of adolescents) and using a different data collection method (i.e., paper-and-pencil). In this study a shorter version (12-item) of the original scale was developed, aimed to assess the more impulsive population, and to facilitate incorporation into time limited surveys such as ESPAD. Additionally, this was the first study to explore the scale of this problem behavior in Hungary, and as such, it is an essential step in deciding whether prevention or intervention programs are necessary, and how should they be designed. Consequently, the first empirical study included in my dissertation (Study 1) had three main goals:

(1) to validate the short form of the previously developed Problematic Online Gaming Questionnaire,
(2) to estimate the proportion of Hungarian adolescents who play video games regularly,

(3) and to estimate the prevalence of problematic online gaming in a national sample of Hungarian adolescents.

Another huge problem in the field is the frequent blending of problematic online gaming with problematic Internet use (e.g., Huang, Li, & Tao, 2010). The reason of this practice can be traced back to the dawn of the World Wide Web. When the Internet as a medium became available for the general public, for those not using it regularly (including some of the researchers) the medium seemed a unified entity. However, somewhat later, Griffiths (2000) has pointed out that there was an essential difference between addiction *to* the Internet (generalized Internet addiction) and addictions *on* the Internet (specific Internet addictions such as problematic online gaming, online gambling disorder, or cybersex addiction). Unfortunately, despite the efforts of Griffiths and other researchers (e.g., Kim & Kim, 2010), the practice of referring to problematic online gaming as problematic Internet use (or Internet addiction or similar terms) persisted and can still be encountered today. The biggest problem of blending these terms is making it impossible to know what the respective studies measure and making it difficult to carry out systematic reviews and meta-analyses necessary to summarize the various findings in the field. To draw further attention upon this issue, we conducted a study comparing problematic online gaming (measured by the POGQ-SF validated in Study 1) and problematic Internet use. As a consequence, the second empirical study (Study 2) aimed to

(4) examine the interrelationship and the overlap between problematic online gaming and problematic Internet use along several relevant variables such as gender, time spent using the Internet and/or online gaming, psychological well-being, and preferred online activities.

To date, a large part of the studies conducted in the problematic online gaming field explored the psychological correlates of the behavior via correlations and regressions. These studies are indispensable in the early stage of research, however, more complex associations are also necessary to get a deeper understanding. Based on the alcohol literature where a mediator role of drinking motives between distal influences (e.g., trauma symptoms) and drinking problems was reported (e.g., Cooper, Frone, Russell, & Mudar, 1995; Kuntsche, Knibbe, Engels, & Gmel, 2007), we assumed that an indirect link existed between psychiatric distress and problematic online gaming (assessed by the POGQ) via the mediation of online gaming motives. Therefore, in Study 3 we aimed to

(5) explore the role of psychiatric distress and gaming motives in problematic online gaming by testing a complex mediation model

(6) to test possible moderating effects of gender and game type on the mediation model

Perhaps the most important question of all is how to define, conceptualize and operationalize problematic online gaming. There is a huge debate among scholars about the name, content and criteria of problematic gaming (e.g., Kardefelt-Winther, 2014; King & Delfabbro, 2013; Starcevic, 2013). The last empirical study included in my dissertation aims to contribute to this question. More specifically, it evaluates the usefulness and validity of each of the nine Internet gaming disorder criteria proposed by the DSM-5 by testing how they perform at different severity levels of the disorder using an Item Response Theory approach. Additionally, we aimed to statistically test the possible Internet gaming disorder cut-off points (using Latent Class Analysis, sensitivity, and specificity analysis) since the one proposed by the APA was arbitrarily chosen without being tested empirically. In order to assess Internet gaming disorder and its proposed components as defined by the DSM-5, our research group developed a measurement instrument called Ten-Item Internet Gaming Disorder Test (IGDT-10). Consequently, the fourth empirical study included in the present work (Study 4) had three aims:

(7) to validate the Ten-Item Internet Gaming Disorder Test (IGDT-10) instrument,
(8) to evaluate the nine Internet gaming disorder criteria proposed by the DSM-5,
(9) and to evaluate statistically the cut-off threshold (i.e., endorsing five out of nine criteria) for Internet gaming disorder proposed by the DSM-5.

2. Empirical studies

2.1. Study 1: Psychometric properties of the Problematic Online Gaming Questionnaire Short-Form (POGQ-SF) and prevalence of problematic online gaming in a national sample of adolescents[1]

2.1.1. Methods

Data were collected with the European School Survey Project on Alcohol and Other Drugs (ESPAD) (Hibell et al., 2012). The target population of the ESPAD

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[1] The present chapter is the exact copy of the following paper: Pápay, O., Urbán, R., Griffiths, M. D., Nagygyörgy, K., Farkas, J., Elekes, Z., Felvinczi, K., Demetrovics, Z. (2013). Psychometric properties of the Problematic Online Gaming Questionnaire Short-

project is adolescents aged 16-years. To obtain a representative group sample, three different grades (8–10) were included in the Hungarian sample, each containing a proportion of the target population. The survey applied an internationally homogenous stratified random sampling method based on region (Central/Western/Eastern Hungary), grade (8–10), and class type (Primary general, Secondary general, Secondary vocational and Vocational classes). The sampling unit was the class, and every classroom student present completed the questionnaire. Refusal rate was 15%, therefore data were weighted due to skewed non-response. Students were surveyed in March 2011. Questions regarding online gaming were only included for the representative sample of 9th-10th graders in secondary general and secondary vocational schools (n=5,045; 51% male, mean age 16.4 years, SD=0.87 years). The present analysis was carried out on the subsample of those who had played online games in the past month (n=2,804; 55.6% of total sample; 65.4% male; mean age 16.4 years, SD=0.85 years).

Major socio-demographic information (age, gender, residence), grade point average, online gaming habits (e.g., type of online games played, frequency of playing, duration of typical gaming sessions), and psychological characteristics, including depressive symptoms (short-form [6-item] Center of Epidemiological Studies Depression-Scale [CES-D]) (Radloff, 1977) and self-esteem (Rosenberg's Self-Esteem Scale [RSES]) (Rosenberg, 1965) were assessed.

Problematic online gaming was assessed using the 12-item POGQ-SF. The POGQ was originally an 18-item scale with good psychometric properties based on wide empirical content developed by the authors (Demetrovics et al., 2012). It measures six dimensions of problematic use (preoccupation, overuse, immersion, social isolation, interpersonal conflicts and withdrawal). The 12-item version of POGQ was developed by selecting two items from each factor. Item selection took into account preservation of high content validity and selection of the highest possible factor loadings.

2.1.2. Main results

A six-factor solution with confirmatory factor analysis (CFA) was tested. The model provided an optimal fit to the data (χ^2= 277.35 df=39 p<.001; CFI=0.972; TLI=0.953; RMSEA= 0.047 [0.042-0.052] Cfit>0.90; SRMR=0.025). Alternatively, the degree of fit of a one-factor model and a model with one second-ordered factor were estimated. The original six-factor model yielded superior fit compared to both the one-factor model and the second-ordered factor

Form (POGQ-SF) and prevalence of problematic online gaming in a national sample of adolescents. *Cyberpsychology, Behavior, and Social Networking, 16*(5), 340-348.

model. In the six-factor model the factor loadings were higher than 0.70 with their respective factor. The composite reliability of each dimension was above 0.60. The average variance extracted from each scale was adequate and above 0.50. Gender invariance of the six-factor model including configural, metric and scalar invariances was also tested.

A latent profile analysis on the six dimensions of problematic online gaming was performed to identify the gamers whose online game use was considered as problematic. According to fit indices AIC, BIC, SSABIC, entropy, and the L-M-R test, the three-class solution was selected. The features of the three classes are shown in Figure 1. The first class (68% of gamers; 37.8% of total sample) represents those gamers who scored below the average on the POGQ-SF factors. The second class of gamers (23.9% and 13.3% respectively) represents the low-risk of problematic use, while the third class (8.2% and 4.6% respectively) represents the high-risk for problematic online gaming population. In all three groups, especially the second, the 'immersion' factor showed an elevated level compared to the other five dimensions.
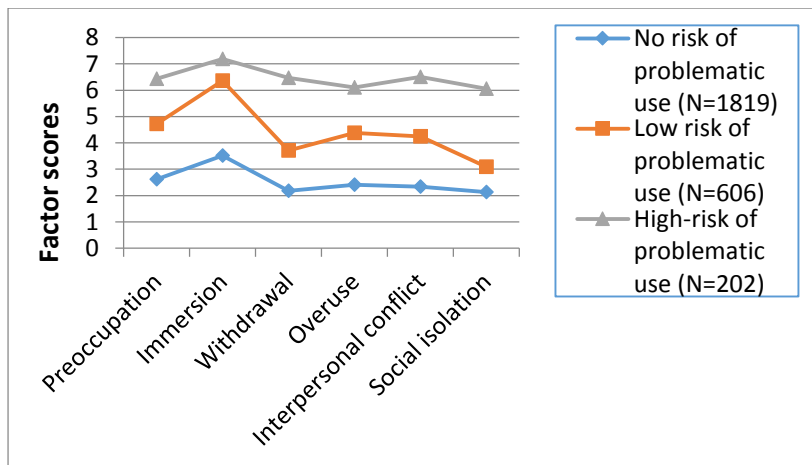
3.3.3. Figure 1. *Latent profile analysis on the six factors of the POGQ-SF*

Gamers belonging to the high-risk class were more likely to (a) be male, (b) play over five hours a day, (c) have lower grade-point average, (d) have lower self-esteem, and (e) higher level of depressive symptoms, than gamers belonging to the other two classes.

Considering the membership in the third class (high risk for problematic online gaming) as the "gold standard", the sensitivity, specificity, positive predictive

value, negative predictive value, and accuracy of the POGQ-SF at all possible cut-off points was calculated. Based on this analysis, a cut-off score of 32 points is an optimal cut-off to classify online gamers as problematic gamers.

2.1.3. Discussion

Results showed that the 12-item POGQ-SF has appropriate psychometric properties according to the CFA performed on a nationally representative adolescent sample. Latent profile analysis revealed 8.2% of gamers (4.6% of total sample) belong to the high-risk group. This prevalence value is in accordance with other large sample surveys conducted (e.g., Gentile, 2009; Rehbein, Kleimann, & Mößle, 2010). The "immersion" dimension showed an elevated level at all three LPA classes, especially the low-risk group. The two items of this dimension ("How often do you play longer than originally planned?" and "How often do you lose track of time when gaming?") indicate excessive use of online games, immersion in gaming, and losing track of time. Since low-risk groups could be the focus of future prevention programs, immersion should be highlighted when developing such programs.

Gamers belonging to the high-risk class were more likely to be male, play over five hours a day, have lower grade-point average, have lower self-esteem, and higher depression score than gamers belonging to the other two classes. These results concur with findings of other studies confirming the measurement tool's validity. Several studies claim males are at higher risk in becoming problematic online gamers (e.g., Cole & Griffiths, 2007; Rehbein et al., 2010) and that problematic online gamers spend greater time playing than normal gamers (e.g., Gentile, 2009; Hsu, Wen, & Wu, 2009). Some studies also note that problematic gamers' school performance is negatively affected by their gameplay (e.g., Porter, Starcevic, Berle, & Fenech, 2010; Young, 2009) and are characterized by lower self-esteem (e.g., Ko, Yen, Chen, Chen, & Yen, 2005; Lemmens, Valkenburg, & Peter, 2011). Furthermore, some studies have demonstrated that depression is a comorbid disorder in problematic online gaming (e.g., Gentile et al., 2011; Peng & Liu, 2010).

The POGQ is short, comprehensive, and assesses problematic online gaming in different age groups with different data collection methods. Therefore POGQ is an adequate tool for assessing problematic online gaming, facilitating future research, and helping legal authorities and health practitioners develop prevention and treatment programs.

2.2. Study 2: Problematic Internet use and problematic online gaming are not the same: Findings from a large nationally representative adolescent sample[2]

2.2.1. Methods

Study 2 used the same dataset as Study 1. The initial sample comprised 5,045 students. After removing cases where answers to problematic Internet use and problematic online gaming questions were completely missing, the sample comprised 4,875 adolescents (50.4% boys, mean age 16.4 years, SD=0.87). However, analyses were carried out only on those who had played online games during the month preceding data collection (n=2,073, 69.1% boys).

Basic sociodemographics (i.e., gender and age) along with school performance (grade average), and information regarding Internet use and online gaming (time spent on these activities and the three most frequently used Internet activities) were collected. Problematic Internet use (PIU) was assessed using the 6-item version of the Problematic Internet Use Questionnaire (PIUQ-6) (Demetrovics et al. 2015, unpublished manuscript). Problematic online gaming (POG) was measured using the aforementioned 12-item POGQ-SF (Problematic Online Gaming Questionnaire Short-Form) (Pápay et al., 2013). Psychological characteristics such as depressive mood (short-form [6-item] Center of Epidemiological Studies Depression-Scale [CES-D]) (Radloff, 1977) and self-esteem (Rosenberg's Self-Esteem Scale [RSES]) (Rosenberg, 1965) were also assessed.

2.2.2. Main results and discussion

The data show that while average daily Internet use was distributed fairly equally between the three time categories (i.e., less than 2 hours, 3-6 hours, more than 7 hours), online gaming substantially decreased as the time categories increased. The results also show that while online gaming is accompanied by high amounts of Internet use, the opposite is less true. Namely those who spend a lot of time using the Internet do not necessarily spend a lot of time playing online games. To find out the scale of PIU and POG and the overlap between the two, four different groups were created: (i) neither problematic Internet users, nor problematic online gamers (80.2%), (ii) problematic Internet users but not

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[2] The present chapter is the exact copy of the following paper: Király, O., Griffiths, M. D., Urbán, R., Farkas, J., Kökönyei, G., Elekes, Z., Tamás, D., Demetrovics, Z. (2014). Problematic Internet Use and Problematic Online Gaming Are Not the Same: Findings from a Large Nationally Representative Adolescent Sample. *Cyberpsychology, Behavior, and Social Networking, 17*(12), 749-754.

problematic online gamers (8.8%), (iii) problematic online gamers but not problematic Internet users (4.3%), (iv) both problematic Internet users and problematic online gamers (6.7%). These results are in line with the literature suggesting higher Internet use than online gaming (Rehbein & Mößle, 2013; van Rooij et al., 2010) and higher PIU than POG in adolescent samples (Rehbein & Mößle, 2013).

In order to compare the association of PIU and POG with relevant predictor variables, a multivariate multiple regression was carried out. Results demonstrated distinctive associations of some predictor variables with the two outcome variables. Being male was associated with both problem behaviors, however, the association was stronger for POG (β = -.29 $p<.001$) than for PIU (β = -.07 $p<.01$). More than five hours of Internet use on an average day had a stronger association with PIU (β = .20 $p<.001$) than POG (β = .07 $p<.01$), while online gaming for more than five hours on an average day had a closer association with POG (β = .20 $p<.001$) than PIU (β = .07 $p<.01$). Self-esteem had a very low standardized effect on both entities (β = -.08 $p<.01$ for PIU and β = -.09 $p<.01$ for POG) while depressive symptoms showed slightly stronger association with PIU (β = .29 $p<.001$ vs. β = .22 $p<.001$). In addition, school performance measured by grade point average had a very low positive effect on both problem online behaviors (β = .05 $p<.05$ for PIU and β = .07 $p<.01$ for POG). In relation to the six Internet activities that were offered to be rated as one of the three favorite online activities (i.e., searching for information, playing online games, chatting, using social network sites, sending emails, and downloading) only playing online games was considerably associated with POG (β = .20 $p<.001$) while playing online games, online chatting, and social networking were all associated with PIU though their effect sizes were negligible (β = .09 $p<.01$, β = .06 $p<.01$, and β = .05 $p<.05$, respectively).

The very low effect size of social networking on PIU was surprising. One explanation might be that the popularity of social networking sites in Hungary began to grow exponentially following the period of this data collection. The recent increase of smart phone ownership (Forsense, 2013) might also change the findings of the upcoming ESPAD research in relation to activities such as social networking. Also interestingly, low self-esteem had low standardized effect sizes on both problem online behaviors. These findings are in line with some previous research (Rehbein & Mößle, 2013) but contradict some other studies (Caplan, 2002; Niemz, Griffiths, & Banyard, 2005). However, depressive symptoms were associated with both PIU and POG but affecting PIU slightly more. This again supports much of the previous literature (Yau, Potenza, & White, 2013; Yen, Ko, Yen, Chang, & Cheng, 2009). Based on the findings of the present study, POG appears to be a conceptually different behavior than PIU.

The results clearly show that the two types of problematic online behavior appear to involve different populations and are associated with different contributing factors.

2.3. Study 3: The mediating effect of gaming motivation between psychiatric symptoms and problematic online gaming: An online survey[3]

2.3.1. Methods

Data collection took place online through gaming forums and websites in 2009. The mean age of the sample (N=3,186) was 21.1 years (SD 5.9 years, range 14-54 years), and the majority of the sample (89.74%) were male.

Data relating to major sociodemographics were collected including age, gender, marital status, and education. Additionally, data were collected regarding weekly game time and preferred game type. The intensity of psychiatric distress was assessed using the Global Severity Index (GSI), an index calculated from the BSI (Derogatis, 1975; Urbán et al., 2014). Problematic online gaming was assessed using the Problematic Online Gaming Questionnaire (POGQ) (Demetrovics et al., 2012), while online gaming motives were assessed using the Motives for Online Gaming Questionnaire (MOGQ) (Demetrovics et al., 2011). This questionnaire measures 7 distinct gaming motives. *Social* motivation concerns the need of gaming together with others and making friends. *Escape* refers to gaming in order to avoid real life problems and difficulties. *Competition* concerns the defeating of others, whereas *skill development* is about improving the player's own coordination, concentration, and other skills. *Coping* involves stress, tension, or aggression reduction through gaming as well as getting into a better mood. *Fantasy* refers to trying out new identities and/or activities in virtual game words that are not possible in the gamers' everyday lives. Finally, *recreation* concerns gaming for the playing of the game for fun.

2.3.2. Main results

It was hypothesized that general psychiatric distress has both a direct and indirect effect (via the mediating effect of the 7 online gaming motives) on problematic online gaming. According to the results (see Figure 2), psychiatric symptoms had a significant direct effect on problematic online gaming (standardized effect=.35, *p*<.001) as well as on all the gaming motives apart from recreation

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[3] The present chapter is the exact copy of the following paper: <u>Király, O.</u>, Urbán, R., Griffiths, M. D., Ágoston, C., Nagygyörgy, K., Kökönyei, G., & Demetrovics, Z. (2015). Psychiatric symptoms and problematic online gaming: The mediating effect of gaming motivation. *Journal of Medical Internet Research, 17*(4), e88.

(standardized effects ranging from .10 to .55, *p*<.001). Psychiatric symptoms were significantly and strongly associated with escape, coping, and fantasy, and significantly but weakly associated with skill development, competition, and social motives. In relation to the association between gaming motives and problematic use, only escape and competition motives had a considerable effect size (standardized effect=.26 and .21, respectively), whereas social motives, skill development, and recreation motives had significant but low effect sizes. In relation to the indirect effect between psychiatric symptoms and problematic gaming, 2 paths were statistically significant and had a considerable effect size: (1) psychiatric symptoms → escape → problematic gaming (standardized effect=.139, *p*<.001); (2) psychiatric symptoms → competition → problematic gaming (standardized effect=.046, *p*<.001). The mediation pathways added up a total standardized indirect effect size of .194 (*p*<.001). The proportion of the mediated effect in the total effect was 35%. Therefore, higher levels of psychiatric symptoms were associated with higher escape and competition motives that were associated with higher level of problematic use. The full model explained 44% of the total variance of problematic online gaming.
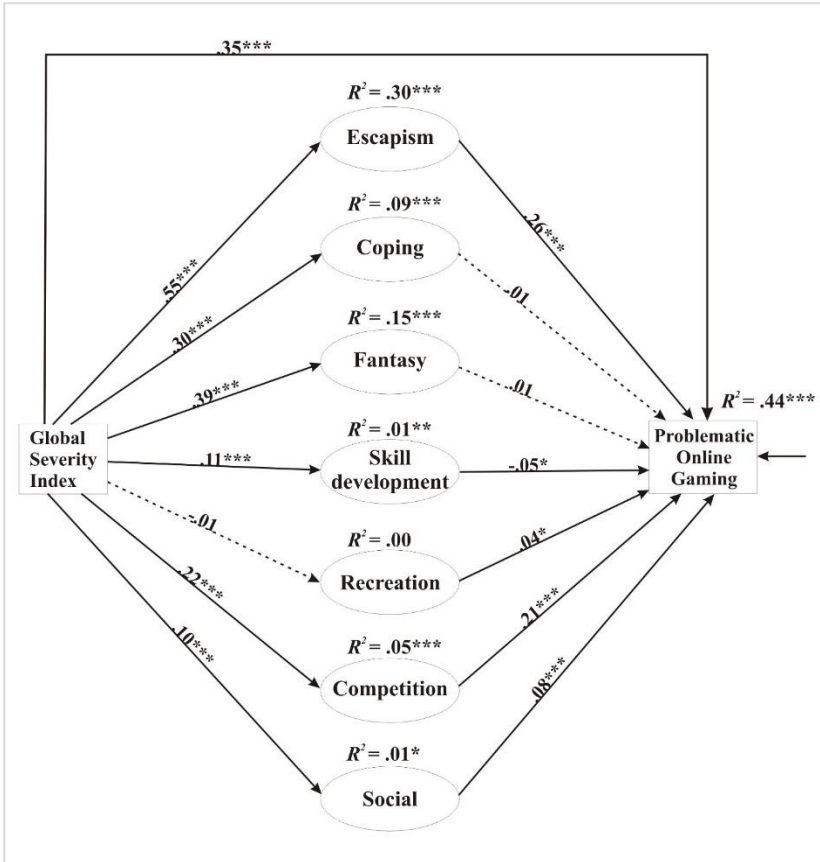
Figure 2. *The overall mediation model with standardized path coefficients and the explained variance of the endogen variables (R^2) (N=3,186)*

Note: All 7 mediator variables are latent variables. For clarity, indicator variables associated with them have not been depicted in this figure but were published in an earlier paper (Demetrovics et al., 2011). Also for clarity, the covariances between the errors of all mediator variables have not been depicted in the figure. Simple arrows: significant path coefficients, dotted arrows: nonsignificant path coefficients. *p<.05; **p<.01; ***p<.001.

It was also hypothesized that game type preference (preference for massively multiplayer online role playing games [MMORPGs] or multiplayer online first person shooters [MOFPSs]) and gender could have a moderating role in these associations. However, the comparison of the two player types (preferring

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different game types) showed no significant differences in the model. Results relating to gender differences, on the other hand, showed a significant difference in the escape → problematic online gaming direct link between male and female MMORPG players (see Figure 3). The standardized direct effect size of this link was .20 (p=.001) for men and .64 (p<.001) for women. The group difference between males and females was significant (Wald test=6.11, p=.01). As a result, the psychiatric symptoms → escape → problematic online gaming mediator pathway for female players had a much higher standardized effect size (standardized effect=.368, p<.001) than the one for male players (standardized effect=.111, p=.001). The total explained variance of problematic online gaming by the model was also slightly higher for female players (53%) than for males (44%).
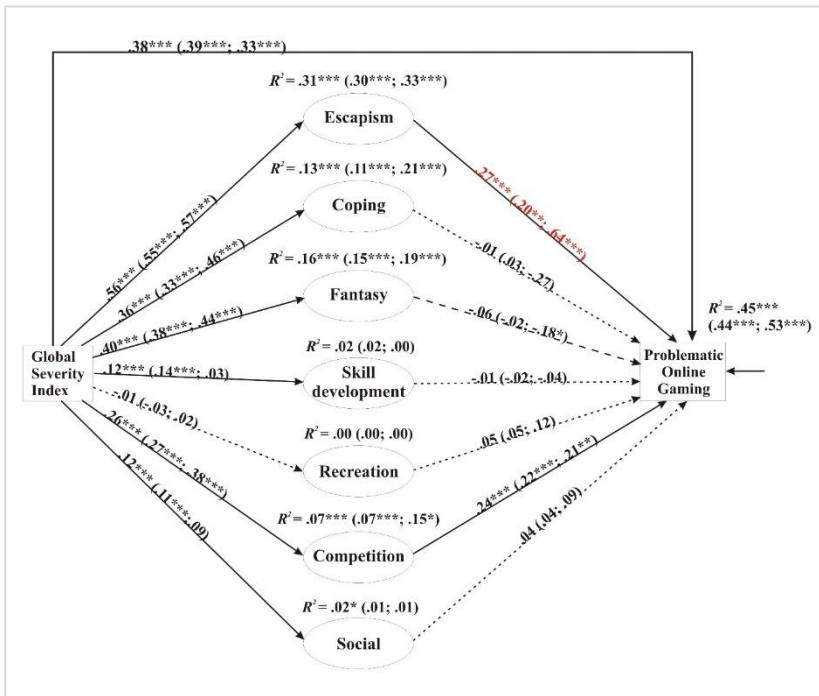

Figure 3. *The mediation model and standardized path coefficients. Results of multigroup analysis and path coefficients across both genders (males/females) and the explained variance of the endogen variables (R^2) (males: n=1,226; females: n=240)*

Note: The first values (left of the brackets) describe all MMORPG players. The first (left) values in the brackets describe male MMORPG players, whereas the second (right) values describe female MMORPG players. Color red indicates a significant difference between male and female players according to the Wald test. All 7 mediator variables are latent variables. For clarity, indicator variables associated with them have not been depicted in this figure but were published in an earlier paper (Demetrovics et al., 2011). Also for clarity, the covariances between the errors of all mediator variables have not been depicted in the figure. Simple arrows: significant path coefficients; dotted arrows: nonsignificant path coefficients. *p<.05; **p<.01; ***p<.001.

2.3.3. Discussion

The present study showed that escape and competition mediated between psychiatric symptoms and problematic gaming. Playing games to escape everyday difficulties appears to be a motivating behavior that can ease psychiatric distress, and thus extends self-medication theory (Khantzian, 1985) to online gaming. This theory states that substance use is a coping strategy through which users try to compensate their psychiatric distress and attain emotional stability. This compensatory behavior then contributes to the development and maintenance of the problem behavior. The findings outlined in the present study also strengthen the inclusion of escapism as an individual criterion for Internet gaming disorder in DSM-5 (American Psychiatric Association, 2013).

The second mediator variable in the present study was competition. Despite the fact that competition is usually considered a healthy and adaptive behavior, our findings suggest that in some cases it can also be a pathological factor. This has also been reported in the literature on problem gambling in which problem gamblers have been shown to be more competitive than non-problem gamblers (Parke, Griffiths, & Irwing, 2004). Gamers whose psychiatric distress level is high might use online gaming as a source for achievement through defeating other players and winning in general. If games are the only sources that maintain and boost their self-confidence and self-efficacy, and thus become a replacement for real life competition and achievement, the activity appears to increase the risk of developing a problematic behavior. However, this reasoning needs further confirmation.

In contrast to pre-study expectations, coping did not mediate between psychiatric distress and problematic gaming. Earlier motivational research yielded the surprising finding that although highly correlated (r=.60), coping and escape are

distinct motives (Demetrovics et al., 2011), and the present study strengthened the argument that these two motives have different mechanisms of action. The results of the present study suggest that in contrast to playing to escape everyday problems, gaming can also be used as an adaptive coping strategy for stress release or tension reduction without necessarily leading to problematic use. A possible explanation might be that different underlying mechanisms lie behind the two strategies. Avoiding real life problems (i.e., escape) only alleviates the perceived stress for a short time, retaining or further multiplying the original problem (i.e., stress source). On the other hand, channeling everyday stress, tension, or aggression into gaming (i.e., coping) can be an active coping mechanism where at least some extent of the perceived stress is dissipated while playing. However, this is speculative and requires further research.

The recreational use of online games was neither related to psychiatric symptoms nor to problematic use of games. This suggests that playing online games can be a healthy form of entertainment if it is used moderately and balanced with other leisure time activities (i.e., sports). This result also serves as counterweight for media scaremongering that often exaggerates the potential dangers of video games (Griffiths, 2010).

The model was found to be invariant across game type preference but varied significantly between males and females in the case of MMORPG players. As expected, females were characterized by a stronger link between escape and problematic online gaming and also had higher escape scores than males. This latter result is in-line with Yee's findings (2006) that examined the motivational background of MMORPG players and also found that female players scored higher on the escape motive than male players. However, the present study suggests that this higher inclination for escape motivation among females is linked to a higher risk of problematic use. In contrast to the other pre-study assumptions, no gender differences were found regarding competition and social motives.

2.4. Study 4: Validation of the Internet Gaming Disorder Test (IGDT-10) and evaluation of the nine DSM-5 Internet Gaming Disorder criteria[4]

2.4.1. Methods

Data collection took place online in 2014. Calls for participation were spread through Facebook with the cooperation of a gamer magazine. The sample

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[4] The present chapter is the exact copy of the submitted version of the following paper: Király, O., Sleczka, P., Pontes, H. M., Urbán, R., Griffiths, M. D., & Demetrovics, Z.

comprises 4,887 online gamers (mean age 22.2 years [SD = 6.4], age range 14-64 years, 92.5% male), most of whom played for more than 15 hours weekly. Educational level was above average, and most were single and studying.

Basic sociodemographic variables, weekly gaming time, the Brief Symptom Inventory (Derogatis, 1975), the Problematic Online Gaming Questionnaire (Demetrovics et al., 2012), and the Ten-Item Internet Gaming Disorder Test (IGDT-10) were administered to the respondents.

The Ten-Item Internet Gaming Disorder Test-10 (IGDT-10) comprises 10 items and assesses levels of Internet gaming disorder (IGD) according to the nine DSM-5 criteria. The last IGD criterion was operationalized via two items given its complexity. Response options for the ten items were "never", "sometimes", and "often" instead of "yes" and "no". The 3-point Likert scale was preferred in order to facilitate the responses given by participants as it makes the decision easier and more realistic. However, during scoring the IGDT-10 items were recoded into a "yes" (1) and "no" (0) format in order to resemble the dichotomous structure of IGD in DSM-5. Since IGD criteria in the DSM-5 suggest that behaviors or problems are frequently repeated or continuously present, only "often" answers were recoded as "yes".

2.4.2. Main results and discussion

To validate the instrument, a one-factor solution of the nine IGD items was tested with CFA. The model provided a good fit to the data ($\chi2$=194.4 df=27 p<.0001; CFI=0.971; TLI=0.962; RMSEA=0.036 [0.031-0.040] Cfit>0.90 pclose=1.000; N=4,887). Factor loadings of all nine indicators of the IGDT-10 were above the conventional threshold of .50 (Table 1). Additionally, the pattern of covariates of the IGDT-10 was tested with a structural regression model (Figure 3). The two instruments measuring problematic online gaming (i.e., IGDT-10 and POGQ) were strongly correlated (r=.77). Additionally, their associations with psychiatric distress and gaming time were comparable, IGDT-10 having slightly higher associations with both explanatory variables.

(2015). Validation of the Internet Gaming Disorder Test (IGDT-10) and evaluation of the nine DSM-5 Internet Gaming Disorder criteria, *under review*.
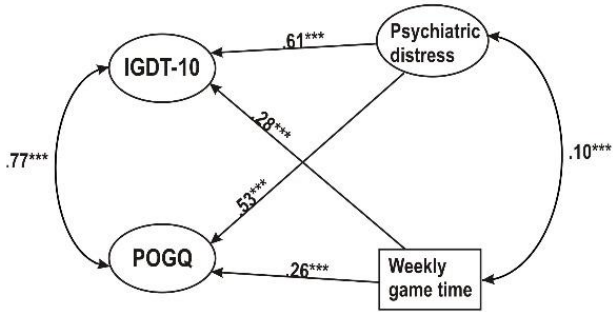
Figure 3. Structural regression model to test construct validity of IGDT-10. *Note:* values on simple arrows are standardized regression coefficients; double-headed arrows indicate correlations between two variables; *** $p<.001$

Table 1. Endorsement of the nine IGD criteria, factor loadings, and item response theory parameters of the criteria

	Endorsement in the total sample (N=4,856-4,883)		Endorsement among the disordered group (≥5 DSM criteria) (n=138)		Factor loading (one-factor model) (N=4,887)	Discrimina tion parameter a Estimate (SE) (N=4,887)	Severity parameter b Estimate (SE) (N=4,887)
	N	%	N	%			
Criterion							
1. Preoccupation	982	20.1	106	76.8	.55	0.66 (0.04)	1.51 (0.07)
2. Withdrawal	154	3.2	55	39.9	.73	1.07 (0.09)	2.54 (0.12)
3. Tolerance	226	4.6	77	55.8	.72	1.04 (0.08)	2.33 (0.10)
4. Loss of control	324	6.6	73	52.9	.66	0.89 (0.06)	2.26 (0.10)
5. Giving up other activities	215	4.4	76	55.1	.74	1.10 (0.08)	2.30 (0.10)
6. Continuation	754	15.5	128	92.8	.80	1.35 (0.08)	1.27 (0.04)
7. Deception	238	4.9	70	50.7	.70	0.98 (0.07)	2.36 (0.10)
8. Escape	631	13.0	105	76.1	.61	0.78 (0.05)	1.83 (0.08)

9. Negative consequences	516	10.6	112	81.2	.74	1.10 (0.07)	1.69 (0.06)
Subjects endorsing ≥5 IGD criteria	138	2.9					
Total endorsed criteria					$M = .83$	$(SD = 1.36)$	

Note: Sample sizes for analyses related to "Endorsement in the total sample" varied due to cases with missing values.

Based on the five criteria endorsement suggested in DSM-5 as the cut-off threshold for classifying disordered gamers, IGD prevalence rate in the present sample was 2.9% (n=138). The endorsement of each IGD criterion in the total sample and among disordered gamers is in Table 1. "Preoccupation" was the most frequently endorsed criterion (20.1%) among all gamers, while "continuation" was the most commonly endorsed criterion among disordered gamers (92.8%).

In order to evaluate the performance of the nine IGD criteria, we carried out an Item Response Theory analysis (IRT). According to the IRT, IGD is manifested through a different set of symptoms depending on the level of severity of the disorder. More specifically, "continuation", "preoccupation", "negative consequences" and "escape" were associated with lower severity of IGD, while "tolerance", "loss of control", "giving up other activities" and "deception" criteria were associated with more severe levels. Based on conditional inference tree analysis, Rehbein et al. (2015) reported that the criterion "giving up other activities" and "tolerance" were key in identifying IGD. Being associated with more severe IGD levels in the present study may help explain why endorsement of these criteria corresponds to a high probability of a positive IGD diagnosis (Rehbein et al., 2015).

Additionally, "preoccupation" and "escape" provided very little information to the estimation IGD severity. This parallels the findings of Rehbein et al. (2015) who found that "escape" and "preoccupation" poorly predicted IGD despite being endorsed at high rates. Additionally, Lemmens et al. (2015) found that "escape" had the lowest specificity in distinguishing between disordered and non-disordered gamers, while Ko et al. (2014) reported that "deception" and "escape" had the lowest diagnostic accuracy to discriminate individuals with IGD from non-problematic individuals. Therefore, replacing these two criteria ("preoccupation" and "escape") with new ones that better discriminate (high a

parameter) disordered gamers in less severe stages (low b parameter) of IGD might be beneficial.

To test whether the cut-off value suggested by the DSM-5 (i.e., five or more criteria) fitted the data empirically, a latent class analysis (LCA) was performed. The fourth LCA group (the one with the highest IGD values) was used as the gold standard to determine the optimal cut-off threshold to distinguish gamers of this group from the remaining sample. Based on sensitivity, specificity, positive and negative predictive value, and diagnostic accuracy of each cut-off score, the empirical data supported DSM-5's suggestion for IGD cut-off threshold (i.e., endorsement of five or more criteria).

3. Summary of findings

Overall Study 1 suggests that the 12-item POGQ-SF along with the original 18-item POGQ (Demetrovics et al., 2012) proved to be a psychometrically valid and reliable instrument to assess problematic online gaming. Additionally, it was found that 55.6% of the Hungarian 9th–10th graders in secondary general and secondary vocational schools play online games regularly, and almost two-third (65.4%) of the regular gamers are male. 4.6% of these adolescents belong to the 'high-risk' group, meaning that online gaming causes problems in their everyday life. Study 2 supports the argumentation than problematic Internet use and problematic online gaming are two distinct conceptual and nosological entities. Study 3 revealed that psychiatric distress had both a significant positive direct effect and a significant indirect (mediating) effect on problematic online gaming via two gaming motives: escape and competition. Moreover, it was found that women scored slightly higher on escape motive and had a stronger path between the escape motive and problematic online gaming than men. Study 4 suggests that the Internet Gaming Disorder Test (IGDT-10) – an instrument developed to assess the nine Internet gaming disorder (IGD) criteria proposed by the DSM-5 – also has proper psychometric characteristics. Additionally, it was found that IGD is manifested through a different set of symptoms depending on the level of severity of the disorder. More specifically, "continuation", "preoccupation", "negative consequences" and "escape" were associated with lower severity of IGD, while "tolerance", "loss of control", "giving up other activities" and "deception" criteria were associated with more severe levels. Furthermore, "preoccupation" and "escape" criteria had very low discriminatory power. Finally, the empirical data supported the DSM-5 suggestion for the IGD cut-off threshold (i.e., endorsing five out of nine criteria).

4. Limitations

All our studies were self-administered, survey-type, questionnaire studies, collecting cross-sectional data from Hungarian-only participants, and as such have several limitations. Self-reported data is sensible to memory recall biases and also to social desirability bias, especially in the case of sensitive topics such as addiction. Survey-type, questionnaire studies are adequate to test broad and general hypothesis, but are not suitable to explore deep underlying mechanisms behind a problem behavior. The cross-sectional nature of the data unfortunately makes it impossible to infer causality regarding the variables tested. And finally, the national and cultural homogeneity of our samples must be taken into consideration when generalizing the results to other cultures. Additionally, two of the studies used self-selected online samples that affect the samples' representativeness (Khazaal et al., 2014) and therefore the generalizability of the results as well. The other two studies used a nationally representative adolescent sample, therefore self-selection was not an issue in those cases.

5. Conclusions

The theoretical part of the present dissertation (not presented in the present work) aims to provide an overview of problematic online gaming, while the four empirical studies wish to contribute to some of the field's important questions and challenges such as conceptualization, assessment, or exploration of underlying psychological and motivational mechanisms. Unfortunately, the central question, namely, whether problematic gaming is a psychiatric disorder or not, remains unanswered. Future task of researchers in the field is to pile up well-designed, methodologically correct studies which help clarify the most important questions and reach (or at least approach) a consensus. This consensus would be a great help to treat the problem adequately, both on the individual and the societal level. Video games have become one of the most popular leisure time activities, therefore we need to learn how to use them in a healthy and responsible way. Research is indispensable to differentiate between real dangers and media scaremongering, and it is the task of researchers and fellow experts to educate the society about healthy media use including video games.

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