MASARYK UNIVERSITY

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Excessive Internet Use and Internet Gaming Addiction

Habilitation Thesis

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Abstract

This habilitation thesis presents the results of an empirical investigation of works that were published in nine peer-reviewed journals. The articles mainly focused on excessive internet use (EIU) and internet gaming addiction (IGA) among adolescents and young people through the analysis of data from extensive and representative data from the EU Kids Online II project, the Net Children Go Mobile project, the Health Behaviour in School-aged Children project, and a Czech project on gaming addiction supported by the Czech Science Foundation. The main aim of the studies was to identify the associated factors of EIU, IGA, and non-pathological gaming engagement. Special attention was paid to social risks factors, the use of other substances, and individual risk factors. The findings suggest that individual risk factors, most importantly attention difficulties and impulsivity, play an important role in both EIU and IGA. Also, both EIU and IGA were associated with the use of substances, most notably stimulants (e.g., caffeine) that increased the overall engagement and the negative effects, although the role of sedatives was stronger for IGA. This suggests the convergence of media and other forms of problematic and addictive behaviours, like substance use. Also, the results suggest that social factors deserve more attention because the quality of the environment in which young people grow up (e.g., family situation, atmosphere, quality of neighbourhood) seems to be reflected in the levels of EIU.

Content

Introduction

The internet and new digital communication technologies have become integral parts of life in our current society. This is particularly valid for younger people, who do not know a world without online access. This proliferation of the internet, which is a relatively new phenomenon that can include the intense use of some applications, has created uncertainties for both society and individuals with respect to normative behaviour and the potential beneficial and harmful effects.

The potential addictive effects of electronic media use have now been discussed for decades. The first discussion was related to excessive TV watching and it dates to the 1950s (e.g. Meerloo, 1954). With the emergence of new digital technology and its eager adoption by youth, discussion about addiction returned repeatedly — video games in the 1980s (Soper and Miller, 1983); the internet in the 1990s (Griffiths, 1998; Young, 1998); and more recently social networking sites (Kuss and Grifiths, 2011) and massively multiplayer online games (Ng and Wiemer-Hastings, 2005). Although the research was more anecdotal at the beginning — which was often overshadowed by a certain level of media panic that is typical for new media use, especially when it involves children — high quality research has incrementally accumulated evidence that leans towards the justification of media addiction. At the same time, a portion of the experts rejected the connection between addiction and media use — some because addiction (or, more appropriately, 'dependency') was reserved for substance use, and others because the use of medical terms in media research discursively pathologized leisure time activities (Kardefelt-Winther, et al., 2017).

Despite many differences[1] in the conceptualisation of the phenomenon (e.g. whether addiction even exists, whether generalised internet addiction exists, whether addiction to a specific application, which is addressed below, exists), a certain level of consensus has developed in the scientific community.

First, there is a consensus that, under certain conditions, mere excessive media use can generate negative effects. Unlike traditional media (e.g. TV, comic books), current digital media are unique in the intensity with which they are consumed. European adolescents reported that as many as two hours a day of their leisure time was spent on the internet in

[1] There are also a number of terms, however, they mostly describe the same phenomenon: internet addiction (Young, 1999); problematic internet use (Shapira et al., 2000); and pathological internet use (Morahan-Martin and Schumacher, 2000); and digital media addictions. These terms are used interchangeably in this habilitation if not stated otherwise. Also, various terms exist to describe specific internet addictions, e.g. gaming addiction, addiction to computer games, and internet gaming disorder, but they all refer to the same phenomenon.

2010 (Livingstone et al., 2011) and nearly three hours a day in 2018 (Smahel et al., 2020). Some online applications are even more time consuming. Computer games, in particular, stand out in this respect. **Study VII** and **V** used data on computer gamers to show that the average reported time spent in a game was about 30 hour a week (approximately four hours a day), with a subgroup of intensive gamers who reached more than double that amount. General screen time for adolescents (i.e. time spend in front of media, including TV, the internet, and computer games) has been reported to be about eight hours a day for active use (Rideout et al., 2010). The assumption that mere time involvement can produce negative effects is the core of the so-called displacement hypothesis (Lee and Leung, 2008), which holds that media use displaces other activities that are potentially more beneficial or more suitable. For example, spending time playing online games decreases the time one could devote to school, socialisation, sleep, self-development, and physical activities. This, in turn may generate negative effects, like poor school results, lower or more superficial social capital, and a whole complex of health issues, including obesity and repetitive strain injuries (Kalmus, Siibak, and Blinka, 2014). More research attention has been increasingly paid to the relationship between digital media use and sleep patterns (Lam, 2014; Alimoradi et al., 2019). In childhood and adolescence, there is an increased need for sleep; however, there is also a regular routine based on waking early for school. Media use decreases the overall sleep that children get because they tend to use media late in the evening and at night. Also, the quality of sleep is decreased due to rapt attention and physiological arousal (e.g. during gaming) (Ivarsson et al., 2013); due to the supressed levels of the sleep hormone melatonin as an result of blue-screen light exposure (Higuchi, 2005); and due to the increased consumption of caffeine- and sugar-rich beverages to stay awake (Study VI). The decreased quality and quantity of sleep, in turn, has further deteriorating effects on cognitive functions, physical health, behavioural problems, and mental well-being (Cain and Gradisar, 2010; Short et al., 2013).

Second, there has been a progression in the understanding of the phenomenon of addiction, with the acknowledgment of behavioural addictions, in general, and media addictions, in particular. This resulted in the inclusion of Internet Gaming Disorder in an appendix of the Diagnostic and Statistical Manual of Mental Disorders (DSM-V, American Psychiatric Association, 2013) and, even more important, the full inclusion of Gaming Disorder in the International Classification of Diseases, 11th Revision (ICD-11, World Health Organization, 2018). Both inclusions were framed by the unification of substance disorders and impulse-

control disorders that have addiction-like features (e.g. gambling) into one category. Before these changes, addiction was generally accepted only for substances and it was largely defined as a dependency upon a substance (e.g. withdrawal symptoms when the substance was not available or when its presence has decreased in the body). This is something that is not possible for behaviours. However, with the advancement of several fields, like neurology and neuropsychology, it became clear that addiction is connected to the anticipation of pleasure and it is associated with the basic learning that is largely connected in the dopaminergic pathways of mesolimbic brain circuits (Blum et al., 2012). This produced important information that identified certain behaviours and conditions that share specific features (e.g. extreme devotion to fulfil a hunger for satisfaction). It is the presence of these features that define what is or is not addiction, irrespective of whether it is based on substance use or mere behaviour. Despite a few, yet important critical voices (e.g. Starcevic and Aboujaoude, 2017; van Rooij et al., 2018), the majority of present-day research is based on the conceptualisation of media addictions in a way that similar to (substance) addictions (Petry et al., 2014). This is also reflected in the scales used to measure media addictions (King et al., 2013; 2020). There are dozens of original scales to measure internet addiction or gaming addiction, and they are usually comparable to a certain extent because they share the basic components. Significant inspiration for the unification came from the work of Mark Griffiths and his components model of addiction (Griffiths, 2005; however, it is important to note that the components were described in several earlier works and that Griffiths' work could be seen as the unification and popularisation of the concept). To consider some behaviour as addiction, it should ideally have all of the following features: 1) salience or preoccupation — the activity should become the most important of one's life;2) mood modification — one should feel excitement from the activity or from the prospect of engagement in the activity; 3) tolerance — one needs more of the activity to achieve the previous levels of satisfaction that were derived from it; 4) withdrawal symptoms — when one is experiencing unpleasant feelings because of the termination of the activity or when unable to engage in it; 5) conflict — when the engagement reaches such an intensity that it starts to ruin one's life; and 6) the tendency to return to the activity even after acknowledging that it is destructive or after a period of relative control. The key component is probably the conflict. To avoid over-pathologisation, it is important to consider the behaviour as pathological only when it produces enough of problems. For instance, internet gaming disorder, as defined in DSM-V, consists of nine items, and three of them probe associated problems (APA, 2013). But it should be noted that not all negative effects caused by digital

media use constitute an addictive behaviour. As mentioned earlier in this text, mere excessive time spent with digital media may produce certain problems.

Six out of the nine studies that make up this habilitation are based on the use of the generalised internet addiction measurement labelled as the Excessive Internet Use Scale. Since the author of this habilitation played a key role in the creation of this scale, and since it has not been described in detail elsewhere, this is a suitable occasion to do so. The scale itself is based on the components model of addiction (Griffiths, 2005). Originally, it was created by Blinka and Smahel and it consisted of 10 items. It existed in two versions: one to measure generalised internet addiction and one to measure internet gaming addiction. The first, generalised version was used in the World Internet Project in 2008 (Smahel et al., 2009). The second, gaming version was published later (Blinka and Smahel, 2010) and it was used in research on Czech gamers (Blinka and Mikuska, 2014). The generalised version was later adopted by the EU Kids Online II data collection as the Excessive Internet Use Scale; however, due to space constraints typical for large-scale surveys, it had to be shortened to five items. One item needed to be removed and the decision was made to abandon the euphoria/mood changes criterion for several reasons. First, previous studies identified euphoria as a peripheral criterion rather than the core one (Charlton and Danforth, 2007). Second, and probably the most important reason for most media use, concerns enjoyment and mood management. Thus, we assumed that this item could be removed without compromising the validity of the scale. The scale has been partially validated (**Study II**); however, a full psychometric assessment is still in process and it has not yet been published. So far, the scale has been used in several representative large-scale data collections, all of which focused on adolescents – EU Kids Online II (25 European countries) in 2010; Net Children Go Mobile (seven European Countries) in 2013; Health Behaviour in School-aged Children in the Czech Republic and Slovakia in 2014; EU Kids Online IV (European countries) 2017/2018; Heath Behaviour in School-aged Children in Slovakia in 2018; and in a few other smaller projects. These resulted in a number of empirical studies — in addition to those that I co-authored (e.g. Blinka and Smahel, 2011; Smahel and Blinka, 2012; Kalmus et al., 2015) and those that are part of this habilitaton — further studies include Filakovska et al., 2018; Urbanova et al., 2019; Urbanova et al., 2020; Helsper and Smahel, 2020; Petruzelka et al., 2020; and Popadic et al., 2020.

Third, there is a certain consensus in seeing the issue as relatively uncommon. In other words, the extreme views that media addictions are completely non-existent, on one hand, or an

epidemic, on the other hand, are both in the minority. A current meta-analytical study estimated that the global prevalence of gaming disorder was below 2%, on average, although there is a large variation between 0.2 and 17% in studies. However, studies with higher scientific standards usually reported a lower prevalence (Stevens et al., in press). A similar result can be found in studies that focused on generalised internet addiction (e.g. Durkee et al., 2012). While mild symptoms of internet addiction are more common, a more strict approach produces much lower figures (e.g. 26.5% vs. 0.96% in a Chinese study by Xin et al., 2018). However, as the majority of studies do not have measurement tools that are standardized for a clinical population, the cut-offs for estimating the pathological group in their samples are often difficult to compare to other studies. In general, digital media addictions are not common. This is something to be expected because the distribution of pathologies, in general, and addictions, in particular, do follow a so-called reversed J-curve (Orford, 2001), with only the minority of users facing addiction or severe consequences. A current large study by Orben and Przybylsky (2019) estimated that digital technology itself accounted for only about 0.4% of the variation in adolescents' well-being. The effect of digital technology had similar significance as, for example, wearing glasses, but it was significantly smaller when compared to sleeping and eating patterns, or engagement in various risky behaviours, like smoking or drinking alcohol.

Fourth, the research evidence and theoretical models agree on the contextuality of the phenomenon (i.e. that only certain people in certain situations who use the technology in certain ways are at risk). The technology itself is not powerful enough to simply cause an addiction without an existing predisposition on the side of the user and/or the influence of other risk factors. According to the Differential Susceptibility to Media Effects Model (Valkenburg and Peter, 2013), the actual effects of the media use are influenced by the user's media choice (i.e. what media they choose, how they use it). Further, these choices and the subsequent effects are in a reciprocal relationship. Most importantly, they do not exist in a vacuum and depend on a whole array of individual, social, and societal factors. In other words, to study digital media addictions, we must focus on the structural characteristics of each particular media and why and how they support addictive behaviours. We also have to study the factors on the side of media user (e.g. personality factors and how they vary across pathological and non-pathological users; Starcevic, 2012). It should be noted that the research, theory, and models created to explain digital media addictions have predominantly been focused on psychological factors like personality, motivation, cognition, and coping

styles (Davies, 2001; Brand et al., 2016; Dong and Potenza, 2014) rather than social or even societal factors.

Fifth, when talking about digital media addictions, like (generalised) internet addiction, gaming disorder, and addiction to social networking sites, it is important to be aware of what one can actually be addicted to. Behavioural addictions are, at their core, addictions to behaviours or activities and not to a medium or item. From this perspective, terms like 'internet addiction' or 'smartphone addiction' are inadequate and have been repeatedly criticised (e.g. Starcevic, 2012; Starcevic and Aboujaoude, 2017). This raises the question as to whether internet addiction really does exist. And, if it does, of what activities does it actually consist. Some models do acknowledge the existence of generalised internet addiction or, at least, they assume different mechanisms behind this pathology compared to more application-specific addictions (Davies, 2001, Brand et al., 2017). Other research would prefer to abandon the generalised term in favour of specific applications only because there is little evidence to support generalised internet addiction (Starcevic and Aboujaoude, 2017). My position, and the position of this habilitation, is mixed[2]. I acknowledge the fact that specific applications and activities do matter, and that generalised internet addiction is the sum (an umbrella term) of the problematic uses of specific applications, like gaming and social networking. The issue is that the scales to measure specific application use are difficult to use in large epidemiological surveys due to space constraints. As such, it will probably be used further, but it is difficult to include specific scales for each potentially problematic online application. The disadvantage is that we lose detailed (i.e. application sensitive) information. The advantage is that we do not lose information about the problematic uses of the scales that are not being measured specifically (i.e. we lose depth, we do not lose breadth). To conclude, internet addiction or excessive internet use may also be understood to be umbrella terms for other specific online behaviours, such as excessive online gaming.

[2] 'Generalised excessive internet use' is used in six research articles. 'Specific internet gaming addiction' is used in two research articles.

List of Original Publications

Study I

Blinka, L., Škařupová, K., Ševčíková, A., Wölfling, K., Müller, K. W., & Dreier, M. (2015). Excessive internet use in European adolescents: What determines differences in severity? *International Journal of Public Health, 60*(2), 249-256.

Study II

Škařupová, K., Ólafsson, K., & **Blinka, L.** (2015). Excessive internet use and its association with negative experiences: quasi-validation of a short scale in 25 European countries. *Computers in Human Behavior, 53,* 118-123.

Study III

Škařupová, K., Ólafsson, K., & **Blinka, L.** (2016). The effect of smartphone use on trends in European adolescents' excessive Internet use. *Behaviour & Information Technology, 35*(1), 68-74.

Study IV

Husarova, D., Geckova, A. M., **Blinka, L.**, Sevcikova, A., van Dijk, J. P., & Reijneveld, S. A. (2016). Screen-based behaviour in school-aged children with long-term illness. *BMC Public Health, 16*(1), 130.

Study V

Blinka, L., Škařupová, K., & Mitterova, K. (2016). Dysfunctional impulsivity in online gaming addiction and engagement. *Cyberpsychology: Journal of Psychosocial Research on Cyberspace, 10*(3).

Study VI

Husarova, D., **Blinka, L.**, Madarasova Geckova, A., Sirucek, J., van Dijk, J. P., & Reijneveld, S. A. (2018). Do sleeping habits mediate the association between time spent on digital devices and school problems in adolescence? *The European Journal of Public Health, 28*(3), 463-468.

Study VII

Škařupová, K., **Blinka, L.**, & Ťápal, A. (2018). Gaming under the influence: An exploratory study. *Journal of Behavioral Addictions, 7*(2), 493-498.

Study VIII

Faltýnková, A., **Blinka, L.**, Ševčíková, A., & Husarova, D. (2020). The Associations between Family-Related Factors and Excessive Internet Use in Adolescents. *International Journal of Environmental Research and Public Health, 17*(5), 1754.

Study IX

Blinka, L., Šablatúrová, N., Ševčíková, A., Husarova, D. (2020). Social constraints associated with excessive internet use in adolescents: The role of family, school, peers, and neighbourhood. *International Journal of Public Health*

Author's contribution

Study I: 60%

Study II: 15%

Study III: 15%

Study IV: 70%

Study V: 15%

Study VI: 40%

Study VII: 30%

Study VIII: 40%

Study IX: 50%

Summary of research questions

The general aim of the studies was the investigation of the associated factors of excessive internet use and excessive online gaming. In most of the studies, the target population was adolescents – with the exception of **Study V** and **VII**, which consisted of both adolescents and adults.

Study I investigated the differences between non-excessive, moderately excessive, and excessive adolescent internet users. Specifically, this study looked at several levels of predictors that had been identified in the literature as predictors of EIU and the extent to which they are associated with various levels of EIU severity. The variables include personal characteristics, like gender, age, self-control, and emotional difficulties; family characteristics, like family type and parents' education level; and the manner of internet use, like digital literacy, usage of social networking sites, and computer game play.

Study II was a quasi- or semi-validation of the Excessive Internet Use Scale in 25 European countries. Also, the study evaluated the relationship between EIU and other issues, such as depressive symptoms, anxiety, ADHD, and risky online and offline behaviour. However, the logic of the association between EIU and the other issues was reversed in this paper when compared to what is typical in the literature — we used EIU as an independent variable and investigated the extent to which this factor led to increased problems and psycho-social-somatic issues.

Study III used two similar datasets, which were collected in the same fashion but three years apart (2010 and 2013) to assess the increase or decrease of EIU in adolescents in seven European countries. Also, the study investigated whether the change could be attributed to the proliferation of smartphone usage and the changes in online practices (i.e. activities) that may be associated with the smartphones. The last goal was to study the relationship between EIU and problematic smartphone use.

Study IV investigated the potential relationship between adolescent screen-based behaviours — including watching TV, using the computer, playing computer games, and EIU — and long-term illnesses and conditions, including asthma, allergies, diabetes, and learning disabilities.

Study V analysed online gaming addiction and online gaming engagement (i.e. non-pathological excessive gaming) and the extent to which dysfunctional impulsivity, the frequency of gaming, and gender and age play a role.

Study VI employed a structural-equation model to test the relationship between time spent on digital devices (i.e. internet use, computer games) and school problems (e.g. truancy, academic achievement). Specifically, the moderators of this relationship were tested, including sleep quality and quantity, and the frequency of the consumption of caffeine- and sugar-rich beverages.

Study VII investigated the co-occurrence of substance use and online gaming addiction and engagement. Specifically, the study was focused on gaming while under the influence of substances, including caffeine, alcohol, amphetamines, MDMA, and sedatives, and how substance use is prevalent in the population of those at risk of addictive gaming. Also studied were the general prevalence of substance use while gaming and the motives for gaming under the influence.

Study VIII examined the association between adolescents' EIU, on one side, and a set of parental variables, on the other. These included family type, family socio-economic status, parental care, monitoring, overprotection, the quality of communication, and the time the family spend together.

Study IX studied multiple social constraints — namely those from family, school, peers, and a problematic neighbourhood — and their association with adolescent EIU. These four social domains were selected based on the Problem-Behavior Theory (Jessor, 1987) and the Social Development Model (Catalano et al., 1996), which describe the general problematic behaviour of adolescents.

Methods

Study I analysed data from the EU Kids Online II project (eukidsonline.net). Face-to-face/self-completed data collection that used a random stratified sampling was done in 25 European countries (i.e. Austria, Belgium, Bulgaria, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Lithuania, the Netherlands, Norway, Poland, Portugal, Romania, Slovenia, Spain, Sweden, Turkey, UK) in the spring and summer of 2010. Approximately 1,000 adolescents from each country, aged 9-16 (N=25,142), and their parents, were interviewed. However, the key variable, the Excessive Internet Use Scale was used only for the self-completed sensitive questionnaire that was given to only the 11-16 age group. The final sample used for the studies included in this habilitation thesis consisted of 18,709 adolescents (50% girls).

The study used the Excessive Internet Use Scale, a short five-item instrument to measure the phenomenon of EIU (for in-depth information about the origin of the scale, which was co-created by the author of this habilitation, please see below for a general discussion). The responses were split into three groups because the mean value of the scale was heavily skewed toward the majority of respondents showing no signs of problems associated with internet use. The first, unproblematic, group included a sample up to two standard deviations towards higher EIU (94.2% of the sample). The second, moderately problematic, group included those above two standard deviations above the scale mean (4.4% of the sample). And the third, highly excessive, group was above three standard deviations (1.4% of the sample). Using multinomial and binary logistic regressions, these three groups were compared in a set of predicting variables (i.e. demographics, various online activities, emotional and behavioural variables).

Study II used the same dataset as Study I (i.e. the EU Kids Online II project, adolescents aged 11-16 from 25 European countries, N=18,709). The Excessive Internet Use Scale was used for each country – besides basic descriptive purposes, a reliability (using Cronbach's alpha) and factor analysis (using maximum likelihood method) were employed. Then, 13 constructs (i.e. somatic problems, depressive symptoms, interpersonal problems, school problems, anxiety, ADHD, low self-control, social phobia, risky online behaviour, risky offline behaviour, truancy, theft, premature sexual intercourse, alcohol consumption) that are theoretically associated with EIU were used as dependent variables. EIU was the independent variable and a set of logistic regressions were conducted for each variable in each country (i.e. a total of 325 regression). The relative probability of each construct in each country was calculated and doubled. (Note: the logic used was that the expectation that double the

expected value would be enough to justify the influence of the EIU.) As a result, we obtained an EIUS score that suggested a significant increase in the investigated construct and hence in significantly negative life consequences.

Study III also used data from the EU Kids Online II project; however, it is only from seven countries (i.e. Belgium, Denmark, Ireland, Italy, Portugal, Romania, the United Kingdom). In 2013, a follow-up data collection in these countries was conducted and labelled as the Net Children Go Mobile project (netchildrengomobil.eu). The methodology, sampling, and surveys were similar in both projects, with sample size being the only exception — only 500 participants from each country were included in the later project. The final sample included in the present study consisted of adolescents aged 11-16 a total of 5,018 from the 2010 EU Kids Online project and 2,645 from the 2013 Net Children Go Mobile project. The analysed variables included the Excessive Internet Use Scale, the Problematic Smartphone Use Scale (which was developed and adjusted from the Excessive Internet Use Scale), variables to investigate activities on the internet and on smartphones (e.g. playing games, use of social networking sites, number of activities), and demographics. The mean scores of EIU were assessed and compared (using t-tests) between countries and survey years. Using a stepwise linear regression, with EIU as a dependent variable, the demographics, online activities, and survey year were investigated as independent variables to predict the EIU score. The relationship between EIU and problematic smartphone use was investigated using Pearson's correlation coefficient.

Study IV used data from the Health Behaviour in School-aged Children project (HBSC, hbsc.org), which was collected in 2014 in Slovakia by the Faculty of Medicine, P.J. Safarik University, Kosice. HBSC is focused on children or adolescents in the fifth to ninth grades of school. Data collection was conducted in randomly chosen schools in Slovakia (151 contacted, 130 participated). In the survey, the Excessive Internet Use Scale from the EU Kids Online II project was used. However, only older children (seventh to ninth grades) were asked these questions. The final sample consisted of 2,682 adolescents (Mage=14.11; 49.7% boys). In addition to the five-item Excessive Internet Use Scale, there were questions about screen time (i.e. hours spent a day) of watching TV, general digital-device use, and computer game play. Responses were dichotomised as below two hours a day and above two hours a day. Having a long-term illness was assessed by asking whether some of the following conditions were confirmed by an official diagnosis; the list of conditions included diabetes, arthritis, allergies, cerebral palsy, asthma, and learning disabilities (e.g. dyslexia, dysgraphia).

The relationship between screen-based activities and long-term illnesses were analysed using a set of logistic regressions adjusted for gender.

Study V used data collected in 2014 by the author of this habilitation. The data collection was part of a broader project that conducted longitudinal online surveys (i.e. three waves of data collection, six months apart) of intensive online gamers. The actual data came from the third wave. It comprised of 1,463 online gamers aged 12-69 (Mage=24.4; 90.8% males). The measurement tools included a 24-item Addiction-Engagement Questionnaire (AEQ, Charlton & Danforth, 2007, 2010), which allowed for distinguishing pathological and nonpathological excessive gamers. Further, a 12-item dysfunctional impulsivity subscale of the Impulsivity Inventory Scale (Dickman, 1990) and the frequency of gaming and basic demographics were used. A separate linear regression, with addiction and engagement as dependent variables, was conducted to assess whether impulsivity is a worthy predictor. A set of chi-squares were employed to identify which addiction components were more prevalent or more important in the gamers who suffered from dysfunctional impulsivity compared to those who did not.

Study VI analysed the same data as Study IV (i.e. data collected within the HBSC project in Slovakia in 2014). However, this study was not limited by the use of the Excessive Internet Use Scale so it could use a larger pool of data. The final sample comprised of 7,595 adolescents (Mage=13.53; 48.1% boys). The measures included 1) time spent on digital devices (which consisted of general computer work and playing computer games); 2) school problems (which consisted of questions about academic achievement, truancy, liking school, and being stressed by school); 3) sleep quality (two items on sleep difficulties, duration of sleep); and 4) soft-drink and energy-drink consumption (two items). A structured equation model was employed to assess the direct and indirect effects of time spent with digital devices, sleep quality, and caffeine- and sugar-rich beverages on school problems.

Study VII was based on data from the same project as Study V. However, in this case, a second wave of data collection was used. The final sample used in this study comprised of 4,004 gamers (Mage=22.16; 92.4% males). The Addiction Engagement Questionnaire was used to measure pathological and nonpathological excessive gaming. Besides basic demographics and the frequency of gaming, a set of drugs were presented with a question about whether the respondents ever used them, whether they used them during game play, and what the motivation was for gaming under the influence. Included substances were caffeine, tobacco, alcohol, cannabis/resin, amphetamines, ecstasy/MDMA, cocaine, stimulant-type pharmaceutics, hallucinogens, sedatives and tranquilizers, and legal highs. Included motives were for better concentration, to stay awake, for courage, for enjoyment, to calm down, to

suppress hunger, to fall asleep, no reason, or no-game-related reason. Descriptive statistics were calculated together with t-tests (to compare addicted and engaged users) and chi-squares (to assess the distribution of users and non-users by gaming genre).

Study VIII analysed the same data as Studies IV and VI (i.e. data collected within the HBSC network in Slovakia in 2014). The final sample used in this study comprised of 2,547 adolescents aged 13-15 (Mage=14.32, 50.9% boys). The Excessive Internet Use Scale was used as the main variable. Further measures included basic demographics; digital screen time; family socioeconomic status; family composition; a scale for parental care, which was composed of eight items from Parental Bonding Instrument: A Brief Current Form (Klimidis, Minas, and Ata, 1992) and four items from Multidimensional Scale of Perceived Social Support (Zimet, Dahlem, Zimet, and Farley, 1988); a scale for parental overprotection, which was composed of eight items from Parental Bonding Instrument: A Brief Current Form (Klimidis, Minas, Ata, 1992); parental monitoring (composed of five items); quality of communication with parents (composed of two items); and time spent together as a family. A stepwise linear regression analysis was conducted with EIU as a dependent variable and the rest of the variables as independent variables (demographics as controls in the first step and family/parental variables in the second step).

Study IX analysed data collected within the HBSC network in Slovakia in 2018. The methods of data collection were similar as those used in Studies IV, VI, and VIII. The final sample consisted of 8,402 adolescents aged 11-15 (Mage 13.44, 50.9% boys). The measures included the Excessive Internet Use Scale; perceived family wealth; and emotional and behavioural difficulties, which were measured by 20 items from the Strengths and Difficulties Questionnaire (Goodman, 2007) and the four social domains and constraints associated with them: family (four items), school (six items), peers (four items), and neighbourhood (three items). As the main analytical method, a stepwise linear regression was used with EIU as the dependent variable. Independent variables were entered in three steps (demographics in the first, emotional and behavioural difficulties in the second, and social variables in the third). In the fourth step, the interaction of social, emotional, and behavioural difficulties were entered to test their potential moderating effect.

General Discussion

This habilitation presents the results of research I conducted in recent years on the topic of excessive internet use and internet gaming disorder[3]. The published articles are largely based upon the notions described in the Introduction (i.e., using components of addiction to describe the excessive use of digital media) and the contextuality of media effects (i.e., the importance of individual and social factors, characteristics of the media that are essential for the development of this problematic behaviour). The focus of the articles was not ground-breaking, per se, and the collective works did not introduce new theories or models for behavioural addiction; however, this contribution cumulates the research evidence through highly rigorous research methods — specifically, high quality representative samples and psychometrically and statistically sound research instruments. Despite this focus, some of the findings could be considered novel and advancements in the field. Special attention should be given to the findings about the use of substances while gaming (**Study VII**) and the finding that a problematic neighbourhood is a risk factor for EIU in adolescents (**Study IX**).

The overall results could be summarized in the following way (with more detailed descriptions of some below): (1) There is a difference between pathological and nonpathological EIU and IGA, and this difference is not reflected only by the mere extent of the excess (**Study V** and **VII**); (2) Higher impulsivity or lower self-control (e.g., manifestations of dysfunctional impulsivity, learning disabilities, conduct problems) are psychological and individual factors that are strongly associated with EIU and IGA, and they put an individual at risk of the development of this pathology (**Studies I**, **II**, **IV**, **V**, **and IX**); (3) There is evidence that the use of substances is associated with EIU and IGA; however, the amount of media use is connected to the use of stimulants, while the addiction is related to use of depressants (**Study VI** and **VII**); (4) Social factors should be considered in both research and practise, especially because both the family (e.g., poor families) and problematic neighbourhood play significant roles in adolescent EIU (**Study VIII** and **IX**); and (5) Although the generalised measurement of EIU was used in most of the studies, extreme levels were related to gaming rather than other activities (**Study I**) and the trend of increasing EIU

[3] I decided to skip other topics upon which I conducted research, mostly to keep this habilitation as thematically condensed as possible. This predominantly relates to the topic of sexuality and media that I have been researching with dr. Anna Ševčíková. This includes the potential effects of the excessive use of the internet for sexual purposes (Ševčíková, Blinka, & Soukalová, 2018; Ševčíková, Blinka, Škařupová, & Vašek, 2020) and the effects and associated factors of internet use for sexual purposes, either for adolescents (Ševčíková, Blinka, & Daneback, 2018) or seniors (Ševčíková, Vašek, Blinka, Macháčková, & Ježek, 2020).

in European adolescents was identified and explained by the number of activities that are done online rather than by the mere shift to mobile platforms, like smartphones (**Study III**).

The finding that impulsivity, in various forms of measurement, is strongly associated with both EIU and IGA was common across studies. **Study I** found that lower self-control and playing computer games distinguished highly excessive from moderately excessive (and also non-excessive). **Study II** found several factors that are closely related to EIU, including ADHD, lower self-control, and various problematic behaviours (that, in adolescence, usually signify self-control issues; Maneiro et al., 2017). Among the long-term health issues, only learning disabilities (which significantly overlap with ADHD; Mayes et al., 2000) were predictors of EIU in **Study IV**. Similarly, **Study IX** used the Strength and Difficulties Questionnaire (which also includes impulsive and problematic behaviour subparts; Goodman, 1997) and found it to be a stronger explanatory factor for EIU than the social factors. **Study V**, which evaluated impulsivity with relation to gaming addiction and gaming engagement, found a link between them. However, this link was rather weak (with an explained variance of about 7% and with moderate association). The reason may be that this study included both adolescent and adult gamers. As impulsivity peaks in late adolescence and declines during adulthood (Steinberg et al., 2008), it is possible that it is a stronger factor in the development of addiction in younger gamers and internet users. Also, **Study V** found that addicted gamers had a higher tendency to relapse into problematic behaviour after periods of relative control. This is an important issue for potential treatment because impulsivity was found to be an obstacle in the treatment of other behavioural addictions (Maccallum et al., 2007). To conclude, particularly for adolescents, higher impulsivity is an important risk factor for EIU and IGA.

It has been claimed that energy drinks are a potential health issue for young people (Pomeranz et al., 2013; Breda et al., 2014). **Study IV** showed that they, indeed, have negative effects — the association between excessive screen time and school problems was moderated by sleep patterns, which were strongly influenced by the consumption of caffeine- and sugar-rich drinks. The direct effect of media use on school problems was rather small, which suggests that the displacement hypothesis (in this case, the assumption that school problems emerge because too much time is dedicated to media use and there is no time left for the school preparation and homework) cannot, by itself, explain the association. Not only does it matter how much adolescents use the media, but it also matters when (i.e., at night) and what other factors are involved (i.e., caffeine consumption). Further, **Study VII** discovered that using

media, in this case computer gaming, is associated with the use of various substances. Nearly three quarters of individuals use caffeine while gaming. The use of alcohol and tobacco was generally high. Nearly 15% used illicit substances while gaming. Those who were gaming under the influence of a substance tended to spend much more time in the game (e.g., stimulants produced an average of 10 additional hours of gaming). Interestingly, the addiction score was higher for the users of tranquilizers, which are used for calming down and relief from anxiety and other negative emotional states, rather than for stimulants. This result supports prior research that identified escapism as a strong motivational predictor for addicted gaming (e.g., Kuss et al., 2012), and it is in concordance with the more general view of addiction as self-medication (Khantzian, 1997; Suh et al., 2008). Also, emotional difficulties were identified as predicting factors for excessive internet use by **Study I** and **II**. To conclude, my results support the notion that there is a trend in the convergence between addiction-like behaviours, in general, and media based-addictions and other forms of addictive behaviours, in particular (e.g. Burleigh et al., 2019; Macey & Kinnunen, 2020). In the case of adolescents, this could mean that media-based addictions occur with other problematic behaviours and, thus, their mutual associations should be studied together.

Study IX used an approach from both the Problem-Behavior Theory (Jessor, 1987) and the Social Developmental Model (Catalano et al., 1996) to evaluate the role of social factors in EIU among adolescents. Both theories are often used for adolescent problematic behaviour, like delinquency. The previous paragraph described the fact that EIU and IGA co-occur with other problematic behaviours, like substance use, and, thus, especially for adolescents, EIU may be associated with such behaviours. Both theories evaluate four basic socializing domains – family, peers, school, and neighbourhood. In the case of the EIU research, the role of family has so far attracted the largest amount of attention (Li et al., 2014; Schneider et al., 2017), while only some attention has been paid to peers and school, and no attention has been paid to neighbourhood. As **Study IX** found, the family constraints were the strongest predictor, while peers and school were not significant. Interestingly, the role of problematic neighbourhood was a novel finding. To a certain degree (because the role of psychological factors are stronger when compared to social factors), EIU in adolescents could be understood to be a social issue that is connected to the socioeconomic status of their neighbourhood and their ability to spend meaningful and safe time outdoors. This finding is supported by **Study VIII**, which found that families that put little emphasis on building their child's own competence and independence paired with lower family socioeconomic status to increase

adolescent EIU. To conclude, despite the overall strength of psychological factors in research on EIU and gaming addictions (e.g., reflected on the well-accepted and applied theories, such as the Person-Affect-Cognition-Execution Model, Brand et al., 2016, or the Cognitive-Behavioural Model of Internet Gaming Disorder, Dong & Potenza, 2014), these results remind us that social conditions do influence young people's behaviour, in general, and media use, in particular (Valkenburg & Peter, 2013).

Also, the publications in this habitation support the necessity for distinguishing pathological and non-pathological intensive media use. Specifically, while IGA found its way into the official diagnostic manual (ICD-11), it is important to note that computer gaming is not pathological, per se. Although **Study I** found that extreme levels of EIU are associated with gaming rather than other online activities, these extreme levels were assigned to about 1% of the sample (a number that is not dissimilar to that found by recent evaluations of global prevalence; Stevens et al., in press). In other words, only a minority of gamers experience pathology associated with excessive gaming. Also, **Study V** and **VII** found structural differences between pathological and non-pathological intensive gaming. Impulsivity played a role in gaming addiction, but it did not play a role in gaming engagement (i.e., non-pathological intensive gaming that affects only peripheral factors of addiction). And, while sedative use was more common in gaming addiction, stimulant use was more common for gaming engagement.

Future research directions

As stated in the Introduction, research on the addictive potential of digital media use has accelerated in the last decade, largely due to the official acknowledgement of behavioural addictions, in general, and media-based addictions, in particular (APA, 2013; WHO, 2017). The amount of research published every year is enormous (i.e., 2,276 empirical articles on the WoS database; Tran et al., 2020) and it seems that we have, from certain perspectives, a good understanding of who, to what source, to what extent, and in what circumstances internet or gaming addiction is a risk. Although, the research corpus of this habilitation has expanded our understanding of EIU and IGA and contributed to the building of cumulative evidence of risk factors, there are areas that are still unexplored[4]. One area that should be addressed in future

[4] This habilitation and its research was focused on epidemiological or survey investigations. Hence, the future directions are written upon this general aim (more thoughts on epidemiological challenges in research of behavioural addictions in Rumpf et al. 2019). It is worth mentioning that there are other approaches that are essential in the field of media-based or behavioural addictions (e.g., neuropsychology, cognitive psychology, experimental psychology) and that they have their own advances, limitations, and future directions.

research is the broader perspective of media-based addictions. Although we know that EIU shares many underlying factors with other problematic behaviours (i.e., conduct problems, substance abuse, eating disorders), we do not know exactly how EIU is linked to various problematic behaviours, their causes, and consequences, and the potential transformation from one to another. At the same time, we have very little knowledge about the development of media-based addictions over time. Although there has been a number of longitudinal studies (Lam, 2014; Anderson et al., 2017), they are typically one, two, or three years long. This is largely insufficient because we do not know whether the potential pathology has long-term-health or well-being effects that transition from adolescence to adulthood. The last challenge that needs to be addressed in future research is the way we investigate media-based addictions in research, which is typically with a survey. Aside from generalised internet or smartphone addictions, there are many potentially addictive online applications. Sometimes one type of application can significantly vary (i.e., there are many types of games that can be played on various platforms, either with or without virtual reality). There is a big question as to how we can, within the limited space we usually have for epidemiological research, meaningfully investigate all of those media uses. This is not only a question for each and every project, but it is also an unavoidable future debate for the scientific community.

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