

# Addictive Potential of Internet Applications and Differential Correlates of Problematic Use in Internet Gamers versus Generalized Internet Users in a Representative Sample of Adolescents

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## Keywords

Internet addiction · Internet gaming disorder · Addictive potential · Problematic Internet use · Gender · Generalized Internet addiction

## Abstract

**Aims:** This paper examines the addictive potential of 8 different Internet applications, distinguishing male and female users. Moreover, differential correlates of problematic use are investigated in Internet gamers (IG) and generalized Internet users (GIU). **Method:** In a representative sample of 5,667 adolescents aged 12–19 years, use of Internet applications, problematic Internet use, psychopathologic symptoms (emotional problems, hyperactivity/inattention, and psychosomatic complaints), personality (conscientiousness and extraversion), psychosocial correlates (perceived stress and self-efficacy), and coping strategies were assessed. The addictive potential of Internet applications was examined in boys and girls using regression analysis. MANOVAs were conducted to examine differential correlates of problematic Internet use between IG and GIU. **Results:** Chatting and social networking most strongly predicted problematic Internet use in girls, while gaming was the strongest predictor in boys. Problematic IG exhibited multiple psychosocial problems compared to non-problematic IG. In problematic Inter-

net users, GIU reported even higher psychosocial burden and displayed dysfunctional coping strategies more frequently than gamers. **Conclusion:** The results extend previous findings on the addictive potential of Internet applications and validate the proposed distinction between specific and generalized problematic Internet use. In addition to Internet gaming disorder, future studies should also focus on other highly addictive Internet applications, that is, chatting or social networking, regarding differential correlates of problematic use.

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## Introduction

Internet gaming disorder (IGD) has been included in the current DSM-5 as a condition warranting further research [1], which is associated with a number of psychosocial and psychopathological problems ranging from sleep disturbance, lower academic performance to comorbidity with depression, anxiety, and attention deficit/hyperactivity disorder (ADHD), to cite a few [2–6]. Recently, other Internet applications have been investigated regarding their addictive potential, encouraging the view of different subtypes of Internet addiction besides gaming, such as the problematic use of social networking sites

(SNSs), pornography, gambling, or shopping platforms [7, 8]. It has been proposed that these specific forms of problematic Internet use (SPIU) can be described as addictive behaviors that could be engaged in offline (with SNSs being an exception, see [9] for a discussion), but are possibly enhanced by the Internet. Furthermore, they should be distinguished from a generalized form of problematic Internet use (GPIU), which refers to a rather aimless use of the Internet, engaging in multiple activities without clear preferences [9–11]. This early differentiation of 2 conceptually distinct forms of Internet addiction by Davis [11] in 2001 has since received empirical support by a number of studies [7, 10, 12, 13], demonstrating that it is meaningful to distinguish specific forms of Internet use from generalized use.

It has further been argued that Internet applications differ in their addictive potential due to their range of rewarding properties [14–16]. Specifically, Internet gaming [16], online sex offers [17], and online chatting [14, 18, 19] are thought to harbor a high addictive potential, which can be defined as a high number of problematic users in proportion to non-problematic users. Furthermore, recent studies have demonstrated that users differ on several levels, such as sociodemographics, individual predispositions, and psychosocial symptoms, according to their preferred Internet application [7, 20]. For instance, it can be assumed that the addictive potential of specific Internet applications varies with gender. Of the few studies that have compared the addictive potential of different Internet applications within the same sample, most of them drawing on data from large multicenter EU projects [19, 21], only one has taken gender differences into account [22]. Published in 2012, this study demonstrated significant gender differences regarding the addictive potential of downloading content, playing online single-user games, reading/posting news/discussion groups, and social networks. Other studies have reported that female gender predicts problematic SNS use [2] and male gender predicts problematic gaming [2, 23]. Based on these findings, it can be hypothesized that girls might be more prone to develop problematic SNS use, while boys are more susceptible to the addictive potential of video games. More research is necessary to investigate differences in the addictive potential of specific Internet applications as a function of relevant sociodemographic variables such as gender.

Furthermore, differences in individual predispositions and psychosocial symptoms between SPIUs should be more carefully studied in order to identify possible risk factors. To date, however, most studies have either exam-

ined a unidimensional construct of Internet addiction without further differentiations of used applications, or one specific Internet application, such as gaming, SNSs, or pornography has been investigated with regard to associated risk factors and psychosocial variables. For instance, low conscientiousness and low extraversion were identified as specific risk factors for problematic gaming when compared to a group of pathological gamblers and healthy controls [24]. Another study further compared problematic gamers to pathological gamblers and substance users, reporting that problematic gamers specifically differed in 4 characteristics, showing increased irritability/aggression, social anxiety, ADHD, and lower self-esteem [25].

Some studies have also directly compared aspects of the problematic use of different Internet applications. One study investigated mutual and differential aspects between problematic Internet gamers (IG) and problematic Internet pornography users and found that shyness and low life satisfaction were specific predictors for problematic Internet gaming [26]. Symptoms of problematic Internet gaming and Internet pornography use did not correlate, therefore supporting the idea of distinct conditions. Another recent study reported an association between symptoms of depression and problematic gaming, while problematic use of SNS was linked more strongly to anxiety and symptoms of obsessive compulsive disorder [2]. Furthermore, both forms of SPIU were predicted by ADHD symptoms, even though this association was lower in problematic gaming compared to problematic SNS use.

Studies that have specifically compared GPIU and SPIUs have found that GPIU is associated with higher symptom severity [7] than one distinct SPIU and that GPIU is related to a greater risk of axis I comorbidities [27] compared to IGD. Investigating differential aspects of SPIUs and GPIU could advance the development of specialized treatments significantly.

Moreover, the role of dysfunctional coping in the development and maintenance of GPIU and IGD has been highlighted. Testing a theoretical model of GPIU based on Davis' cognitive behavioral model, Brand et al. [10] demonstrated that dysfunctional coping styles and Internet use expectancies mediated the relationship between psychosocial symptoms and GPIU. Another study found that specifically media-focused and substance-related coping predicted problematic Internet use in young adults [28].

In sum, the reviewed findings suggest the importance of gender differences when examining the addictive potential of different Internet applications. Based on find-

ings of current studies, it is highly relevant to differentiate between Internet applications in order to reveal predispositions and psychosocial symptoms associated with problematic Internet use. The lack of such distinctions is also mentioned as a limitation by other authors. For instance, Parker et al. [29] did not find gender differences for Internet use, hypothesizing that gender differences for specific Internet applications might have cancelled each other out.

Consequently, the first aim of this paper is to examine the addictive potential of specific Internet applications taking gender into account. In line with the outlined research, we hypothesize that Internet applications differ in terms of addictive potential in general, with gaming and the use of sexual content exhibiting the highest addictive potential. We expect that addictive potentials of Internet applications differ as a function of gender: gaming should exhibit a higher addictive potential for boys, whereas chatting and social networking should exhibit higher addictive potentials for girls.

Secondly, since IGD is included in the current DSM-5 as a condition in need of further research, psychosocial symptoms and coping strategies are examined for problematic IG compared to generalized Internet users (GIU). Based on previous research, we hypothesize that problematic IG and problematic GIU differ in their pattern of psychosocial problems, with the latter showing increased psychosocial burden. Overall, these findings would further validate the idea of distinct Internet addiction subtypes and contribute to the advancement of specialized treatments.

## Material and Methods

### Participants and Procedure

In total, 42 schools of rural and urban areas in the German federal state of North Rhine-Westphalia were selected by random probability sampling methods after stratification for school type and population density. There was no systematic difference regarding school type or region between participating (54.3%) and non-participating schools. The study was approved by the local Ethics Committee according to the Declaration of Helsinki. Participation in the study was voluntary and written informed consent was given by all participants and, if they were underage, their legal guardians. Overall, 6,081 students filled out a questionnaire during school class provided by the school for data acquisition. The dataset was checked for plausibility resulting in a sample reduction of 6.3% ( $n = 382$ ). Cases with more than 10% ( $>2$ ) missing items in the main instrument, Assessment of Internet and Computer game Addiction-Scale (AICA-S), were excluded. This resulted in a sample size of 5,667 students (50.3% male) aged 12–19 years (mean 15.44, SD 1.73) attending grades 7–13 (mean 9.3, SD 1.56). Sociodemographic variables are shown in Table 1.

**Table 1.** Sociodemographic data of participants

Sociodemographics	<i>n</i>	%
School type		
Lower secondary school	860	15.2
Intermediate secondary school	1,058	18.7
Comprehensive secondary school	848	15.0
College preparatory high school	2,198	38.8
Vocational school	701	12.4
Male gender	2,837	50.3
Female gender	2,804	49.7
1st generation migration	356	6.3
2nd generation migration <sup>1</sup>	1,625	29.6

<sup>1</sup> 2nd generation migration was coded, when at least one parent had immigrated.

### Instruments

**Internet Addiction.** The AICA-S [30] is a self-report comprising 16 items. A clinical score is calculated based on 14 items, ranging between 0 and 27. Scores  $>7$  indicate problematic use and scores  $>13.5$  indicate Internet addiction. Diagnostically relevant items are based on diagnostic criteria of IGD as in DSM-5 and substance use disorders, such as craving, tolerance, withdrawal symptoms, loss of control, preoccupation, and negative consequences in important life domains. Two open-ended questions assessed the time spent actively online per day during the week and during the weekend or holidays. Also, the frequency of use (0 = “never,” 1 = “seldom,” 2 = “often,” 3 = “very often”) regarding 8 Internet applications (gaming, shopping, chatting, e-mailing, sexual content, gambling, social networks, and information research) was assessed. Internal consistency of the AICA-S is reported at  $\alpha = 0.89$  [30]. A sensitivity of 80.5% and a specificity of 82.4% in assessing Internet addiction has been reported in a clinical sample [31].

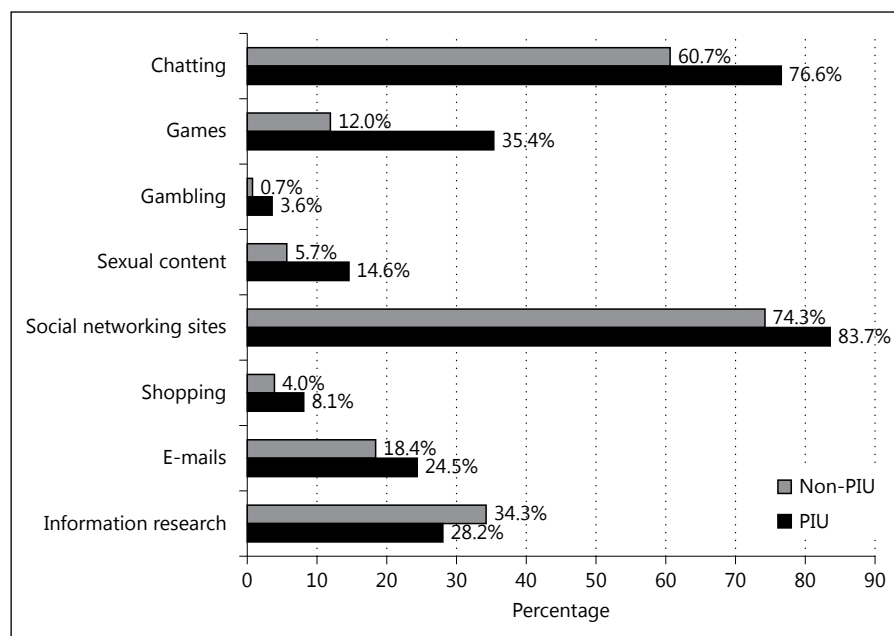
**Extraversion/Conscientiousness.** Extraversion/conscientiousness was assessed using the 2 corresponding subscales of the well-validated NEO-FFI [32]. Each scale consists of 12 statements, which are rated on a 5-point Likert-scale from 0 = “strongly disagree” to 4 = “strongly agree.” Good internal consistency has been reported for the German population (extraversion:  $\alpha = 0.80$ ; conscientiousness:  $\alpha = 0.85$ ) [33].

**Perceived Stress.** The Perceived Stress Scale [34, 35] is a 10-item questionnaire assessing feelings of stress due to lack of control or unpredictable stressful events during the last month. Internal consistency for the German version is reported at Cronbach’s  $\alpha = 0.84$  and correlations with depression ( $r = 0.59$ ), anxiety ( $r = 0.59$ ), and fatigue ( $r = 0.57$ ) indicate constructive validity of the Perceived Stress Scale-10 [36].

**Self-Efficacy.** Self-efficacy was assessed with the General Perceived Self-Efficacy Scale [37], which consists of 10 items ranging from 1 = “do not agree” to 4 = “agree.” Good internal consistency has been reported in a German validation study ( $\alpha = 0.92$ ) [38].

**Psychiatric Symptoms.** The strengths and difficulties questionnaire [39] is a screening instrument for deficits in 4 different domains: emotional symptoms (anxiety/depression), conduct problems (conduct disorder), hyperactivity/inattention (ADHD), and peer problems. A total difficulties score can be computed by add-

**Fig. 1.** Distribution of intensely used Internet applications in problematic Internet users (PIU) and non-PIU in the total sample.



ing the scores of the 4 scales, while a fifth scale assesses prosocial behavior. This paper focuses only on the 4 problem scales. Each scale comprises 5 items, which can be answered with 0 = “not true,” 1 = “somewhat true,” or 2 = “certainly true.” The strengths and difficulties questionnaire has been shown to detect conduct, hyperactivity, depressive, and anxiety disorders in a community sample using multiple informants with good (70–90%) sensitivity [40]. In this study, the self-report version was used. Internal consistency ranges from 0.45 (conduct problems) to 0.70 (emotional problems) [41], which is similar to values in our study (0.51 for conduct problems to 0.74 for emotional problems). Scales with poor (<0.60) internal consistency were excluded; therefore, emotional problems (0.74) and hyperactivity/inattention (0.64) remained for further analysis.

**Coping Strategies.** The BriefCOPE [42] consists of 6 subscales and 12 items. Four subscales identify dysfunctional coping strategies (e.g., self-blame, denial) and 2 subscales identify functional coping (positive reframing, active coping). Since media-focused coping has been identified as a common coping strategy in Internet addiction [43, 44], we included 2 items, which assess media use as another dysfunctional coping strategy. Again, only subscales with  $\alpha \geq 0.60$  were included for further analysis, namely denial (0.62), behavioral disengagement (0.65), self-blame (0.78), and media use (0.82).

#### Statistical Analysis and Operationalization

Statistical analysis was conducted with SPSS version 23 (IBM). Addictive potentials of Internet applications were retained by linear regression analysis with backwards selection to avoid suppressor effects.

Intense use of an Internet application was defined as indicating the highest (“very often”) use of the specific application. IGs were defined as participants who reported intense Internet gaming and indicated using less than 4 other Internet applications intensely. GIUs were defined as participants who reported the

intense use of 5 or more Internet applications. Two one-way MANOVAs were computed to compare non-problematic vs. problematic IG, and problematic IG vs. problematic GIU, respectively. Differences in sociodemographic variables were examined using  $\chi^2$  tests.

## Results

### Prevalence of Internet Addiction

The prevalence of Internet addiction was somewhat high with 2.3% ( $n = 128$ ). Another 11% ( $n = 624$ ) of students were identified as exhibiting problematic Internet use. Both addicted and problematic users were classified as problematic Internet users (PIU), resulting in a subsample of 752 students (13.3%). In the subsample of IG ( $n = 563$ ), 202 participants were positively screened as problematic IG (3.6% of  $n$ ), whereas in the sample of GIU ( $n = 106$ ), 51 participants were classified as problematic GIU (0.9% of  $n$ ). The prevalence of problematic users that only indicated intense use of Internet games without any other application was 0.05% ( $n = 29$ ).

### Intense Use of Internet Applications

Overall, a high proportion of participants indicated intense use of SNS (PIU: 83.7%, non-PIU: 74.3%; Fig. 1) and chatting (PIU: 76.6%, non-PIU: 60.7%). Information research was the third most frequently reported Internet application among non-PIU (34.3%), while gaming was the third most frequently reported activity in PIU (35.4%).

**Table 2.** Internet applications as predictors for problematic Internet use in boys and girls

	Total ( <i>n</i> = 5,330)			Boys ( <i>n</i> = 2,653)			Girls ( <i>n</i> = 2,653)		
	B (SE)	β	95% CI	B (SE)	β	95% CI	B (SE)	β	95% CI
Constant	1.86 (0.07)		1.73 to 1.98	2.02 (0.09)		1.84 to 2.19	1.61 (0.09)		1.42 to 1.79
Chatting	1.14 (0.10)	0.17***	0.95 to 1.34	0.76 (0.15)	0.11***	0.47 to 1.05	1.50 (0.13)	0.24***	1.24 to 1.77
Gaming	2.98 (0.12)	0.29***	2.74 to 3.23	3.08 (0.14)	0.37***	2.81 to 3.35	2.94 (0.37)	0.14***	2.21 to 3.66
Gambling	2.98 (0.44)	0.08***	2.12 to 3.84	2.93 (0.48)	0.11***	1.99 to 3.87	4.20 (1.46)	0.05**	1.35 to 7.05
Sexual content	1.11 (0.18)	0.08***	0.76 to 1.47	1.20 (0.20)	0.10***	0.82 to 1.58	1.79 (0.72)	0.04*	0.38 to 3.20
Social networking	1.25 (0.10)	0.19***	1.06 to 1.44	0.99 (0.14)	0.14***	0.71 to 1.27	1.53 (0.14)	0.23***	1.26 to 1.80
Shopping	0.96 (0.22)	0.05***	0.53 to 1.39	1.07 (0.32)	0.06*	0.43 to 1.70	0.86 (0.30)	0.05**	0.26 to 1.45
E-mailing	0.45 (0.12)	0.05***	0.22 to 0.68	0.58 (0.18)	0.06*	0.24 to 0.93	0.29 (0.15)	0.03	-0.01 to 0.58
Information research	-0.21 (0.09)	-0.03*	-0.39 to -0.03				-0.32 (0.13)	-0.04*	-0.56 to -0.07

β, standardized beta value.

Total:  $F(8, 5322) = 229.39, p < 0.001, R^2 = 0.26 (p < 0.001)$ , boys:  $F(7, 2645) = 151.63, p < 0.001, R^2 = 0.29 (p < 0.001)$ , girls:  $F(8, 2644) = 99.37, p < 0.001, R^2 = 0.23 (p < 0.001)$ .

E-shopping (PIU: 8.1%, non-PIU: 4.0%) was the second least frequently indicated application, followed by gambling (PIU: 3.6%, non-PIU: 0.7%).

#### *Addictive Potential of Internet Applications*

Corresponding to the first aim of this paper, the addictive potential of specific Internet applications was examined by conducting regression analyses for the total sample and for boys and girls separately.

Regression analysis for the total sample indicated that all Internet applications contributed significantly to the explanation of problematic Internet use (Table 2). Internet gaming exerted the highest influence on the model, followed by social networking and chatting. Frequent information research exhibited the least important influence in the model, showing a slightly negative relationship with problematic use. Furthermore, gambling, visiting websites with sexual content, shopping, e-mailing, and information research had low effects sizes ( $\beta < 0.10$ ), indicating that they only explained a low amount of variance in the model.

When male and female users were examined separately, the order of predictors contributing to the explanation of problematic Internet use changed. For boys, gaming remained the strongest predictor and exhibited an even higher influence in the model, followed by social networking, chatting, gambling, and visiting websites with sexual content. E-mailing and shopping had a weaker influence on the model, while information research was excluded in a second step as it had no significant effect on the model.

For girls, chatting and social networking both exhibited comparably strong influences in the model. Interest-

ingly, for girls, the third most important predictor was gaming. Gambling, visiting websites with sexual content, and shopping had a weaker influence on the model. E-mailing did not contribute to the model significantly.

#### *Psychosocial Correlates of Problematic Use in GIU and IG*

In accordance with the second aim of this paper, the specific problematic Internet use of gaming was examined by comparing non-problematic and problematic IG and by comparing problematic IG to problematic GIU.

#### *Sociodemographic Variables*

Sociodemographic characteristics were compared between non-problematic and problematic IG and between problematic IG and problematic GIU. In the sample of IG, problematic users were more likely to have at least one parent with migration background ( $\chi^2 (1, 532) = 5.02, p < 0.05, \phi = 0.10$ ) compared to non-problematic users. No significant differences were found between the 2 problematic (IG vs. GIU) groups. Descriptively, a higher percentage of migration background (2nd generation migration; GIU: 43.1%; IG: 35.1%) and change of school (GIU: 42.6%; IG: 28.1%) was evident in problematic GIU compared to problematic IG.

#### *Psychosocial Variables and Psychiatric Symptoms*

All compared groups did not differ regarding age or gender. Therefore, a one-way (non-problematic vs. problematic use) MANOVA was conducted for the group of IG. Problematic use was associated with lower conscientiousness, higher perceived stress, emotional problems, as



**Table 3.** Psychosocial correlates of problematic use in Internet gamers and generalized Internet users

	IG		IG		GIU		IG ( <i>n</i> = 506): non-prob. vs. prob.			Prob. ( <i>n</i> = 226): IG vs. GIU		
	non-prob. ( <i>n</i> = 324)		prob. ( <i>n</i> = 182)		prob. ( <i>n</i> = 44)		statistic			statistic		
	mean	SD	mean	SD	mean	SD	F(1, 504)	<i>p</i>	$\eta_p^2$	F(1, 224)	<i>p</i>	$\eta_p^2$
Personality and psychosocial variables												
Conscientiousness	2.30	0.60	2.07	0.61	2.09	0.62	16.29	***	0.03	0.02	ns	
Extraversion	2.27	0.46	2.29	0.53	2.29	0.53	0.11	ns		0.00	ns	
Perceived stress	1.58	0.54	1.93	0.59	2.09	0.61	46.69	***	0.08	2.65	ns	
Self-efficacy	2.88	0.42	2.81	0.57	2.96	0.58	2.27	ns		2.42	ns	
Psychiatric symptoms												
Emotional problems	1.92	2.05	2.82	2.49	4.16	3.06	19.46	***	0.04	9.28	***	0.04
Hyperactivity/inattention	3.56	2.19	4.79	2.25	5.16	2.15	35.47	***	0.07	1.00	ns	
Psychosomatic complaints	0.26	0.27	0.44	0.38	0.57	0.46	37.97	***	0.07	4.11	*	0.02
Coping strategies												
Behavioral disengagement	1.54	0.60	1.81	0.79	2.17	0.95	18.62	***	0.04	6.78	**	0.03
Self-blame	2.22	0.74	2.48	0.82	2.58	0.89	13.54	***	0.03	0.53	ns	
Media use	2.16	0.86	2.85	0.94	2.64	1.04	69.22	***	0.12	1.73	ns	
Denial	1.50	0.65	1.69	0.76	1.98	0.88	9.35	***	0.02	4.68	*	0.02

\*\*\*  $p < 0.001$ , \*\*  $p < 0.01$ , \*  $p < 0.05$ , <sup>ns</sup>  $p > 0.05$ . IG, Internet gamers; GIU, generalized Internet users; prob., problematic use; non-prob., non-problematic use.

well as higher hyperactivity/inattention and more psychosomatic complaints compared to non-problematic IG (Table 3). Significant differences were also found regarding coping strategies: problematic IG employed dysfunctional strategies more frequently than non-problematic IG. A medium effect size ( $\eta_p^2 = 0.12$ ) indicated that problematic IG coped by media use significantly more often than non-problematic IG. Medium effect sizes were also found for perceived stress, psychosomatic complaints, and hyperactivity/inattention ( $\eta_p^2 = 0.07$ – $0.08$ ).

A one-way MANOVA (problematic IG vs. problematic GIU) revealed higher psychiatric symptoms in problematic GIU than in problematic IG. Problematic GIU reported significantly higher scores in emotional problems, as well as more psychosomatic complaints. At the same time, problematic GIU indicated using the coping strategies behavioral disengagement and denial significantly more frequently than problematic IG.

## Discussion

The present study pursued 2 main goals: first, to examine the addictive potential of 8 different Internet applications, while taking gender into account. The second pur-

pose was to further investigate problematic Internet gaming by comparing a broad range of psychosocial deficits, psychiatric symptoms, personality traits, and coping styles between problematic and non-problematic IG, as well as problematic generalized users.

Consistent with our hypotheses, Internet gaming was found to show the highest addictive potential. Moreover, in line with recent research, social networking and chatting exhibited the second and third highest addictive potentials. Contrary to expectations, even though the use of sexual content significantly predicted problematic Internet use, it produced only a small effect on the model. This finding might be explained by the fact that the sample consisted of adolescents and data were assessed during school class. It is possible that this topic is associated with more shame in this age period and that participants might have answered in a more socially desirable way, since the classroom environment might have compromised privacy of given answers. In boys, linear regression yielded an even stronger addictive potential for Internet gaming and a slightly lower importance, but nevertheless high addictive potential, for chatting and social networking. In girls, social networking and chatting contributed to the regression model most strongly. While gambling and the use of sexual content exhibited a strong influence in male users,

they showed less significant impact on the prediction of problematic Internet use in female users. Information research had a negative relationship with problematic Internet use, therefore suggesting that problematic users use the Internet less for information research than non-problematic users. E-shopping also exerted a less significant impact on the model compared to other Internet applications, while its impact was comparable between boys and girls.

These results replicate findings of other studies (e.g., [2, 22, 23]) and confirm the assumption that the addictive potential depends on the specific Internet application and the sociodemographic characteristics of its users. An implication of these findings is that future studies examining Internet addiction should consider that effects might cancel each other out when Internet applications are not examined separately and gender or other sociodemographic variables (e.g., age) are not taken into account as a confounding factor. The finding that gaming was the highest predictor for problematic Internet use in boys and chatting was the highest predictor in girls is consistent with previous studies [5, 45]. One unanticipated finding was that gaming exhibited the third highest addictive potential in girls. As of now, gaming has always been viewed as a male domain. Nevertheless, about 10% of IG were found to be female, and this proportion was equal in both non-problematic and problematic IG. It is likely that there are certain video game genres which attract both boys and girls equally. For instance, it has been shown that there are no gender differences in addictive use of free-to-play games [46].

So far, IGD has been included in the DSM-5 as a condition warranting further research as it seems to be the most prevalent subtype of Internet addiction in studied populations. The fact that Internet gaming showed the highest addictive potential in our study further supports the idea of including IGD as a formal disorder in international classification systems such as the DSM or the ICD. Still, other Internet applications, such as chatting and social networking, should also be taken into account as other highly addictive subtypes of Internet addiction. Further evidence is required in order to support our claim that different subtypes of Internet addiction exist, with affected populations differing in specific sociodemographic characteristics and psychiatric symptoms.

Furthermore, psychosocial variables were examined regarding problematic Internet gaming and generalized Internet use. Results show that problematic IG scored significantly lower in conscientiousness than non-prob-

lematic IG. This is consistent with other studies, which have found low conscientiousness to be a key characteristic of IGD [24]. At the same time, no significant differences were found regarding extraversion in problematic IG compared to non-problematic IG. Previous studies have shown that problematic IG scored significantly lower regarding extraversion when compared to pathological gamblers [24] or substance abusers [25]. The reason why no significant differences were found in this study can most likely be identified in the comparison group. In our study, problematic IG were not compared to another clinical sample, but to users of the same Internet application. Therefore, there might be no significant differences within the group of IG and low extraversion cannot be seen as a specific predictor of problematic Internet gaming.

Generally, problematic IG indicated higher psychosocial burden, which can be seen in significantly higher perceived stress, higher scores in emotional problems and hyperactivity, and more psychosomatic complaints compared to non-problematic IG. Moreover, problematic IG applied dysfunctional coping strategies significantly more often than non-problematic IG, with differences in media-related coping yielding the highest effect size. These findings contribute to current research regarding IGD, showing that problematic IG are significantly impaired in their daily life and suffer from a variety of psychosocial symptoms [20, 47]. It is possible, that some of these symptoms might be the cause of dysfunctional coping strategies. Further studies should investigate the role of dysfunctional coping in the development of Internet addiction.

No differences were found regarding personality variables between problematic IG and problematic GIU. However, even though effect sizes were rather small, problematic GIU displayed even higher emotional problems and psychosomatic complaints than problematic IG. Moreover, problematic GIU engaged significantly more often in dysfunctional coping strategies such as denial and behavioral disengagement. These findings can be interpreted in the light of Davis' cognitive behavioral model [11]. Davis postulates that GPIU is linked to the addictive potential of the Internet itself, particularly to its communicative character. It has been assumed that GPIU is associated with a lack of social support and perceived social isolation in real life (cf. [10, 48]). The excessive use of specific Internet applications, however, is assumed to be associated with an individual predisposition that can also lead to excessive behavior offline and is intensified by the opportunities the Internet has to offer. The GIU sam-

ple in this study was found to primarily engage in chatting, social networking, and other communicative applications, which is consistent with Davis' model. Therefore, this study shows that problematic GIUs, who can be characterized as using a variety of communication-intensive applications excessively, are impaired in multiple areas of their daily life and report higher burden than problematic IG.

A limitation to our findings is the operationalization of the sample of IG. Since subjects were not asked to indicate which Internet application they engaged in the most intensely, the sample of IG could also include users who would not classify themselves primarily as IG despite indicating the highest possible answer. The second most intensely used Internet application in this sample was chatting (51.9%). Generally, a high overlap can be observed between chatting (voice chats) and Internet gaming in this age group. As voice chats are often used parallel to Internet gaming to augment the gameplay, Internet gaming can be regarded as the primarily used Internet application. Therefore, we consider the amount of falsely classified IG in this sample as rather low. Another limitation is the cut-off criterion for classifying problematic users. Although the diagnostic screening instrument is one of the few clinically validated instruments for assessing Internet addiction, self-report data are always subject to participants' perceptions and there is always some chance of misclassification. We decided to include both users with problematic and addictive use to yield a larger subsample. Accordingly, the studied samples encompass persons with subclinical Internet addiction who might not be diagnosed with Internet addiction or IGD in a clinical setting.

A noteworthy aspect of this study is its representative character, which allows for the generalization of the findings to all German adolescents. Another strength of this study is the inclusion of specific demographic variables such as gender, which might have compromised findings of previous cross-sectional studies.

This study replicates the finding that Internet gaming shows the highest addictive potential for users. At the same time, communication-intensive applications such as chatting and social networking should be recognized as other highly addictive Internet applications. While girls are more inclined to use these applications in an addictive way, boys are more prone to show addictive use of Internet gaming. Further research should acknowledge the fact that users differ in their sociodemographic characteristics and individual predispositions depending on the preferred Internet applications. In line with recent evidence and current debates concerning the conceptualization of IGD and Internet addiction, the findings of this study emphasize the need to differentiate between specific types of problematic Internet use and urge future studies to distinguish between GPIU and SPIUs.

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## Disclosure Statement

The authors state that there is no conflict of interest.

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