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FULL-LENGTH REPORT



Feels good, and less bad: Problematic use of the Internet is associated with heightened experiences of both gratification and compensation

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ABSTRACT

Background: During the development of addictive behaviors, theoretical models assume a shift from experience of gratification being a driver in early stages to experience of compensation which dominates at later stages of addiction development. Initial studies show a trend in this direction; however, this shift has not yet been investigated in clinical samples. We assume experienced gratification to be highest in individuals with risky use (indicating the beginning of the addiction process), and compensation to be highest in individuals with pathological use. **Methods:** Data from 834 participants from a multi-center study (FOR2974) investigating specific Internet-use disorders (IUDs) including gaming, buying-shopping, pornography use, and social-network use disorders were analyzed about Experience of Gratification (EGS) and Experience of Compensation (ECS), symptom severity, use expectancies, and usage motives. A diagnostic interview based on DSM-5 criteria for gaming disorder was used to classify individuals into either non-problematic, risky, or pathological use group. **Results:** The groups (non-problematic, risky, pathological) differed significantly regarding EGS and ECS. Individuals with pathological use reported highest experiences of compensation but equally high experienced gratification as individuals with risky use. Effects vary with respect to the specific behavior. All measures correlated significantly. Symptom severity was most strongly associated with facets of compensation. **Conclusion:** The experience of gratification and compensation appear to be crucial for addiction-like Internet use. Experienced gratification is already high in individuals experiencing first negative consequences and appear to be stable in individuals with pathological use indicating the relevance of both positive and negative reinforcement during the addiction processes.

KEYWORDS

Internet-use disorder, Internet addiction, behavioral addictions, gaming disorder, positive reinforcement, negative reinforcement

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INTRODUCTION

The question of why individuals take drugs, even though they experience negative consequences, is one that drives researchers in the addiction field. [Berridge and Robinson \(1995\)](#)

discuss that typically drug intake is linked with the experiences of pleasure and positive emotions as well as with the avoidance of unpleasant consequences. Even if this explanation is insufficient, since further underlying mechanisms such as craving experiences and (diminished) self-regulation play a crucial role as well (Berridge & Robinson, 1995), it highlights the importance of positive and negative reinforcement mechanisms such as experience of positive emotions or compensation of negative feelings in the development and maintenance of an addiction. The question remains, if these processes are also relevant in addictive behaviors such as the addictive use of specific Internet applications. Since 2018, gaming disorder and gambling disorder are categorized as “disorders due to addictive behaviors” in the 11th version of the International Classification of Diseases (ICD-11) by the World Health Organization (World Health Organization, 2019). Pornography-use disorder, buying-shopping disorder, and social-network use disorder are discussed as possible candidates for “other specified disorders due to addictive behaviors” (Section 6C5Y) of the ICD-11 (Brand et al., 2022; Fineberg et al., 2022). Based on this argumentation, we postulate a proximity to the addiction framework for the aforementioned behaviors, based on the classification of gaming disorder and gambling disorder in the ICD-11 as disorders due to addictive behaviors, which we transfer to pornography-use disorder, buying-shopping disorder, and social-network use disorder. However, given that the last three terminologies are not yet listed in the ICD-11, we use the more neutral terms and classify the participants as individuals with non-problematic/recreational, risky, and pathological use based on symptom severity. The aim of the current study is to investigate the experience of gratification and experience of compensation due to the use of the preferred online application including gaming, buying-shopping, pornography use, and social-network use in individuals with pathological use compared to individuals with risky and non-problematic usage.

The experience of gratification while using a specific online application has previously been related to the satisfaction of specific needs (Wegmann, Antons, & Brand, 2022). Thereby, the focus is the individual striving for need satisfaction as a fundamental human urge by performing a specific behavior (Deci & Ryan, 2002; Katz, Blumler, & Gurevich, 1974) which even takes a prominent role in the context of addiction research (Brand et al., 2019). Based on the Self Determination Theory, it could be assumed that the experienced gratification due to the use of specific Internet applications are related with the need satisfaction of basic needs such as competence, autonomy, and belonging (Deci & Ryan, 2000). The Uses and Gratification Approach, however, outlines that the Internet use could be associated with experiences of entertainment, finding information, and social interactions, which could result in a repeated usage behavior (Katz et al., 1974). The experience of compensation is based on the assumption that unsatisfied needs, subjectively perceived deficits, or negative emotions are coped with or compensated by using specific online applications (Kardefelt-Winther, 2014; Müller & Wölfling, 2017). Within the addiction framework, both experiences are part of

the reinforcing vicious circle resulting in the manifestation of the (addictive) behavior. The I-PACE model by Brand and colleagues (Interaction of Person-Affect-Cognition-Execution model; 2016), and its updated version (Brand et al., 2019), postulates that the interaction of predisposing variables such as usage motives with affective and cognitive mechanisms could lead to repeated use. The experience of gratification and of compensation while using specific applications are key mechanisms that, through their positive and negative reinforcing effects, could lead to incentive sensitization and craving, followed by diminished control over behavior and to addictive behavior tendencies. In earlier stages of the addiction development, it is outlined that the experience of gratification plays a predominant role since positive experiences are assumed to be main drivers for recurring use. In later stages, when negative consequences and limited control over usage behavior increase, a shift from gratification to compensation is assumed, so that primarily the experienced compensation takes on a decisive role (Brand et al., 2019). In a newer approach by Brand (2022) it is proposed that both positive and negative reinforcement mechanisms are related to a “feels-better” path. Positive reinforcement mechanisms are assumed to be related with the rewarding experiences, experiences of pleasure, or feelings of being socially integrated. Negative reinforcement processes are related with the experiences of stress reduction, decrease of negative mood or feelings, or reduction of loneliness. In contrast to the I-PACE model, no specific shift is assumed, but rather that although reward-related mechanisms play a strong role at the beginning, they continue to be relevant during the development of addiction, while mechanisms of negative reinforcement are involved early on and increase. Thereby especially the compensation of negative emotions is related to a manifestation of the usage behavior which could contribute to the dominance of the “must-do” pathway leading to a persistence of the behavior despite experiencing negative consequences (Brand, 2022). It outlines a juxtaposition of gratifying/rewarding, positive reinforcement and compensating, negative reinforcement assuming a certain behavior manifests itself through an increasing habitualization towards a rather compulsive behavior associated with negative consequences (for a comprehensive overview see Brand, 2022; Everitt & Robbins, 2016).

We developed two questionnaires assessing the experience of gratification (Experience of Gratification Scale) and experience of compensation (Experience of Compensation Scale) while using a specific online application. Based on theoretical considerations and exploratory and confirmatory factor analyses, experienced gratification has been defined by two subscales: gratification of needs and experiences of pleasure, both together representing experienced gratification. Experienced compensation has been defined by two subscales as well: compensation of needs and experience of relief from negative feelings. Moreover, the empirical findings showed that all four subscales were correlated with symptom severity of specified Internet-use disorders. These findings were obtained in a convenience sample with symptom severity assessed on self-report scales (for a detailed overview see Wegmann et al., 2022). Conclusions



about the involvement of gratification and compensation in clinical samples could not be drawn. In the current study, we investigated if the experiences of gratification and compensation differ between diagnostic validated groups of individuals with non-problematic, risky, and pathological usage of the Internet using a standardized diagnostic interview based on DSM-5 criteria for gaming disorder. The differentiation between non-problematic, risky, and pathological use will be based on the amount of symptom severity (DSM-5 criteria for gaming disorder fulfilled, applied to all types of IUDs) as determined by the standardized diagnostic interview. This interview makes it possible to identify groups of individuals who report significant impairments in everyday life due to the use of specific Internet applications. These are people who have not yet been treated therapeutically, but who are assumed to have a disorder with clinical relevance (in the pathological group) or at least risky use or non-problematic use based on symptoms reported/not reported in the standardized diagnostic interview. Given that many studies in the field have been conducted with convenient samples and/or with groups classified according to screening instruments, only, we argued that having groups defined by a standardized diagnostic interview is of particular value for understanding psychological mechanisms underlying Internet use disorders, with a focus on the differentiation between risky and pathological use in accordance with DSM-5 criteria. Based on the assumptions of the I-PACE model, we hypothesized that the experienced gratification differs between the usage profiles such as individuals with non-problematic, risky, and pathological use of specific online applications, with individuals with risky use (representing “early stages” of addiction development) reporting highest experienced gratification. We further assumed that experienced compensation differs between individuals with non-problematic, risky, and pathological use of specific online applications, with individuals with pathological use (representing “later stages” of addiction development) reporting highest experienced compensation. We also assumed that gratification and compensation may be representing one driving factor (“feels-better”-path) and co-occur within the course of addictions (Brand, 2022). Therefore, we tested the alternative hypotheses that both experienced gratification and compensation are highest in the group with pathological use, followed by the group with risky use and lowest with non-problematic use. On an exploratory level, we investigated if the amount of experienced gratification and compensation differ between specific types of Internet-use disorder. In line with the results by Wegmann et al. (2022), we further hypothesized significant correlations of both constructs with symptom severity, specific use expectancies, usage motives, and self-reported habit tendencies.

METHODS

Study procedure

The data used were collected in the multi-center research unit FOR2974 (c.f. Brand et al., 2021). Data collection

started in October 2021. At the time of writing the manuscript and hypothesis testing, data collection was still ongoing. The current data are part of a subsample where data acquisition has been done from October 2021 to July 2023. Participants were recruited at all sites of the research unit including outpatient clinics and treatment facilities for behavioral addictions and on universities via mailing lists, word-of-mouth, and social media (e.g., online postings, newspaper postings, notice boards).

Interested participants had to complete a telephone screening prior to study participation to clarify inclusion (e.g., age ≥ 18 and ≤ 65 years and sufficient German language skills) and exclusion criteria (e.g., learning or developmental disorders, psychosis, mania, current substance-use disorder (except tobacco), acute suicidal ideations, any psychoactive substances known to interfere with performance in the cognitive tasks or with stress reactivity, and concurrent psychotherapy for target behavior). Following this procedure, the groups are not representative for the general population, but representative for individuals who have self-identified with presenting mild/moderate (group of risky users) to severe (group of pathological users) symptoms of a specific IUD and matched control participants with non-problematic/recreational usage. If they were eligible to participate, they were invited. A standardized diagnostic interview was conducted to determine group assignment (i.e., non-problematic, risky, or pathological) based on Internet usage behavior. The participants had to use the specific, preferred online application at least occasionally in the last 12 months. Therefore, participants were asked about their most important and preferred Internet application or the application that was most likely to be associated with individual suffering. If the participants indicated more than one application and were also unable to prioritize them, the standardized diagnostic interview was conducted for all the applications mentioned to determine the first-choice behavior. Individuals for whom no clear first-choice behavior could be determined were excluded from the study. All participants were assessed with a comprehensive core battery of questionnaires, neurocognitive tasks, and experimental paradigms. Only the questionnaires relevant for the current research questions are included here. A more detailed description of the study procedure is given in Brand et al. (2021).

Participants

The sample for this study initially consisted of 898 participants. We excluded a total of 64 participants due to the following reasons: not showing the specific online behavior in the last 12 months ($n = 26$), being in an offline addictive behavior comparison group (i.e., gambling disorder, $n = 9$; tobacco-use disorder, $n = 9$; alcohol-use disorder, $n = 1$), missing data in the standardized diagnostic interview given ($n = 10$), showing at least risky usage for two online behaviors ($n = 3$), or due to problems/difficulties during the experimental procedure ($n = 6$).

The final sample of the current study consists of 834 participants aged between 16 and 65 years ($M = 26.69$, $SD = 8.07$) with 381 males, 447 females, and

6 divers/non-binary gender. The majority of 80.58% of the participants reported a general qualification for university entrance ($n = 672$) followed by technical college entrance qualification (8.75%, $n = 73$), middle school diploma (7.19%, $n = 60$), or “others” (3.48%, $n = 29$) as highest education qualification. Regarding marital status, 87.41% of the participants ($n = 729$) reported to be unmarried/single, 8.15% were married ($n = 68$), while 4.44% reported to be divorced, widowed, or “other marital status” ($n = 37$).

Regarding the specific type of online behavior, the current sample included 272 participants with (non-problematic, risky, or pathological) online gaming, 246 participants with online buying-shopping, 232 participants with social-network use, and 84 participants with pornography use. After the interview, 373 participants were categorized as individuals with non-problematic use, 239 as individuals with risky use, and 222 individuals with pathological use. The description of the groups is summarized in Table 1. The distribution of the behavior patterns (non-problematic, risky, and pathological) was significantly different between the specific forms of online behavior ($\chi^2(6) = 43.54, p < 0.001$). There were also significant differences in age ($F(3, 819) = 10.26, p < 0.001, \eta^2 = 0.036$) between the specific forms of online behavior showing significant differences between gaming and buying-shopping, gaming and pornography, and buying-shopping and social-network use. Participants did not differ in age between the group classification (non-problematic, risky, pathological; ($F(2, 819) = 0.12, p = 0.891, \eta^2 < 0.001$). Gender differences were identified between specific forms of online behavior ($\chi^2(9) = 518.90, p < 0.001$) and group classification ($\chi^2(6) = 49.57, p < 0.001$) (see Table 1 for the exact distribution patterns). However, sociodemographic differences were expected as the result of the different sample definitions of the individual research projects of the research unit and gender- and age-specific prevalence rates. Specifying the online behavior, we identified significant differences in daily use time of the online behavior (minutes per day) between the specific online behaviors ($F(3, 819) = 153.70, p < 0.001, \eta^2 = 0.360$) and participants’ group classification ($F(2, 829) = 89.98, p < 0.001, \eta^2 = 0.180$), which also showed significant interactions ($F(6, 819) = 7.04, p < 0.001, \eta^2 = 0.049$). Post-hoc analyses emphasized highest daily use time in individuals with pathological followed by risky and non-problematic online behavior as well as in the social-network use group followed by the gaming, buying-shopping, and pornography use groups (see Table 1). Addressing the main hypothesis, we used the aggregated sample of all participants investigating specific Internet-use disorders in general.

Measures

We provide a short overview regarding the questionnaires which have been used for addressing the current research questions. A more detailed description of the measurements can be found in the [supplementary material](#).

Table 1. Sociodemographic description of the overall sample and the subsamples

	Aggregated sample			Gaming			Buying-shopping			Pornography use			Social-network use								
	Overall	Non-problematic		Overall	Non-problematic		Overall	Non-problematic		Overall	Non-problematic		Overall	Non-problematic							
		Risky	Pathological		Risky	Pathological		Risky	Pathological		Risky	Pathological		Risky	Pathological						
N	834	373	239	222	272	119	106	47	246	119	66	61	84	43	19	22	232	92	48	92	
Age	26.69 (8.07)	26.83 (8.64)	26.13 (7.14)	27.05 (8.03)	24.93 (4.96)	24.79 (4.44)	27.78 (5.16)	25.57 (5.73)	28.91 (10.92)	28.95 (11.22)	26.05 (8.54)	31.92 (11.92)	31.92 (11.92)	27.60 (6.41)	27.12 (7.23)	29.89 (5.52)	26.55 (5.02)	26.06 (7.40)	26.55 (8.93)	27.75 (8.59)	24.66 (4.14)
Gender (m/f/d)	381/ 447/6	172/198/3	145/9 3/1	64/157/3	238/ 31/3	103/14/2	96/10/0	39/7/1	29/ 217/0	15/104/0	14/52/ 0	0/61/0	84/0/0	84/0/0	43/0/0	19/0/0	22/0/0	30/199/ 3	11/80/1	16/31/1	3/88/1
Daily usage time (min)	156.94 (135.07)	97.71 (104.58)	173.79 (123.31)	238.16 (145.39)	196.69 (142.02)	115.81 (90.63)	230.15 (114.23)	322.55 (179.04)	68.22 (67.00)	28.01 (31.98)	66.64 (38.97)	148.39 (70.16)	57.30 (51.27)	31.48 (24.14)	63.55 (57.00)	102.39 (53.92)	241.19 (124.47)	241.19 (124.47)	195.79 (117.62)	240.30 (108.59)	287.57 (123.16)



Adaptive structured diagnostic interview for Internet-use Disorders. We conducted an adaptive standardized diagnostic interview for specific Internet-use disorders based on the diagnostic criteria for gaming disorder in the DSM-5, which was an adapted version of the AICA structured clinical interview for specific Internet-use disorders (Müller & Wölfling, 2018) and modified for the first-choice online behavior; gaming, buying-shopping, pornography use, and social-network use. Participants who fulfilled five or more of the DSM-5 criteria were classified as individuals with pathological use, participants with less than five but more than one symptom fulfilled were classified as individuals with risky use, and participants who fulfilled one or no criterion were included as individuals with non-problematic use of the preferred online behavior. The interviews have been conducted by trained scientists of the research unit who were regularly supervised by clinically working supervisors and principal investigators.

Assessment of Criteria for Specific Internet-use disorders. As additional measurement of symptom severity we used the Assessment of Criteria for Specific Internet-use disorders (ACSID-11; Müller et al., 2022) which is a screener based on the ICD-11 diagnostic criteria for gaming disorder. The scale assesses the experiences of impaired control, increasing priority, continuation/escalation, functional impairment and marked distress specific for each online behavior performed in the last 12 months. Sum scores were calculated separately for the frequency and severity scales.

Experience of Gratification Scale (EGS) and Experience of Compensation Scale (ECS). The EGS assesses the experienced gratification while using a specific online application (Wegmann et al., 2022). It includes two factors: gratification of needs and experience of pleasure. All items referred adaptively to the targeted specific online behavior.

We used the ECS for measuring the experienced compensation while using a specific online application (Wegmann et al., 2022). Comparable with the EGS, all items were related to the targeted specific online behavior. The ECS includes two factors: compensation of needs and experience of relief from negative feelings.

Internet Use Expectancies Scale. We used modified versions of the Internet Use Expectancies Scale to assess individual expectancies towards the previously selected online application including two factors: positive use expectancies and avoidance expectancies (Brand, Laier, & Young, 2014).

Self-Report Habit Index. We used the Self-Report Habit Index (SRHI) by Verplanken and Orbell (2003) modified for the specific online behavior.

Specific usage motives. For gaming, the Motives for Online Gaming Questionnaire (Demetrovics et al., 2011) has been used which includes the factors: social, escape, competition, coping, skill development, fantasy, and recreation.

For buying-shopping, the Online Shopping Expectancies (Trotzke, Starcke, Müller, & Brand, 2015) has been used.

The questionnaire consists of three factors: buying anonymously/avoiding social interactions, buying availability/product variety, and immediate positive feeling.

We used the Pornography Consumption Inventory (Reid, Li, Gilliland, Stein, & Fong, 2011) for specific usage motives in pornography use which includes four factors: emotional avoidance, sexual curiosity, excitement seeking, and sexual pleasure.

The Motives for Using Social Media scale by Al-Menayes (2015) was used with five factors: entertainment, personal utility, information seeking, convenience, and altruism.

Statistical analysis

Statistical standard procedures were carried out with SPSS 29.0 for Mac (IBM SPSS Statistics). Group differences regarding categorical variables were analyzed using Chi²-Tests. Addressing the hypotheses, we used multivariate analyses of variance (MANOVA) with specific online behavior (gaming, buying-shopping, pornography, social networks) and group (non-problematic, risky, pathological) as between-subject factors. For multiple comparisons, Bonferroni correction was used. Bivariate correlations between variables were analyzed using Pearson's correlations.

Ethics

The research unit as well as all specific projects are pre-registered at the Open Science Framework (<https://osf.io/n5cd7/>) and the study procedure has been approved by local ethics committees. All participants gave written informed consent prior to participation.

RESULTS

Group differences in the aggregated sample of different Internet usage behaviors

We analyzed group differences regarding the online behavior by calculating MANOVA with group (non-problematic, risky, pathological use) as between-subject factor and gratification of needs, experience of pleasure, compensation of needs, and experience of relief from negative feelings as dependent variables. The results indicate significant differences of the three groups in general ($F(8, 1656) = 38.11, p < 0.001, \eta^2 = 0.155$), but also for gratification of needs ($F(2, 831) = 43.39, p < 0.001, \eta^2 = 0.095$), experience of pleasure ($F(2, 831) = 26.87, p < 0.001, \eta^2 = 0.061$), compensation of needs ($F(2, 831) = 134.13, p < 0.001, \eta^2 = 0.244$), and experience of relief from negative feelings ($F(2, 831) = 135.18, p < 0.001, \eta^2 = 0.245$). Post-hoc analyses with Bonferroni correction outline for all variables significant differences between individuals with non-problematic and risky ($p < 0.001$) as well as pathological use ($p < 0.001$) and between individuals with risky and pathological use ($p < 0.001$), except for gratification of needs and experience of pleasure where individuals with risky and pathological use did not differ significantly

from each other ($p \geq 0.329$). Summarized for the aggregated sample, individuals with pathological Internet use showed highest experienced gratification (against the “shift hypothesis” of the I-PACE model) and experienced compensation (confirming the hypothesis of the I-PACE model) compared to individuals with risky and non-problematic use (see Table 2 and Fig. 1).

Investigating exploratory group differences for specific types of Internet use

We calculated a MANOVA with group (non-problematic, risky, pathological) and specific online behavior as between-subjects factors and EGS scores and ECS scores as dependent variables. The results showed significant main effects of

group ($F(8, 1638) = 33.11, p < 0.001, \eta p^2 = 0.139$), online behavior ($F(12, 2167.16) = 29.92, p < 0.001, \eta p^2 = 0.126$), and an interaction effect ($F(24, 2858.36) = 2.73, p < 0.001, \eta p^2 = 0.020$) for all dependent variables (see Fig. 2). Besides the differences between the specific groups already mentioned, post-hoc analyses using Bonferroni correction highlight that for gratification of needs all online behaviors significantly differed from each other except buying-shopping and pornography use ($p > 0.999$). For experience of pleasure, gaming and pornography use ($p > 0.999$) as well as buying-shopping and social-network use ($p > 0.999$) did not differ from each other. For compensation of needs, gaming and social-network use ($p = 0.205$) as well as pornography use and buying-shopping ($p = 0.553$) did not differ from each other. For experience of relief from negative feelings, only pornography and social-network use ($p > 0.999$) did not differ significantly from each other. All other differences were significant (p 's < 0.05).

Overall, individuals with pathological use showed highest experience of gratification (against our hypothesis) and highest experience of compensation (confirming our hypothesis) followed by individuals with risky and non-problematic use. Both gratification and compensation increase with higher levels of symptoms. In addition, the specific type of the online behavior also had an effect on the general experience of gratification and compensation, with highest values of both the experience of gratification and compensation in the gaming group. It becomes clear that when looking at the behaviors separately, significant differences between the individuals with pathological, risky, and non-problematic use persist (see Table 3 and Fig. 2).

Table 2. Descriptive statistics of experience of gratification and compensation of the aggregated sample

	Internet use of the aggregated sample		
	Non-problematic	Risky	Pathological
EGS: Gratification of needs	1.20 (0.82)	1.68 (0.86)	1.81 (0.90)
EGS: Experience of pleasure	2.41 (0.81)	2.81 (0.69)	2.79 (0.74)
ECS: Compensation of needs	0.75 (0.75)	1.35 (0.88)	1.89 (0.93)
ECS: Experience relief from negative feelings	1.01 (0.86)	1.78 (0.91)	2.22 (0.97)

Note. Values represent Means and (in brackets) Standard Deviations.

Aggregated sample of specific Internet-use disorders

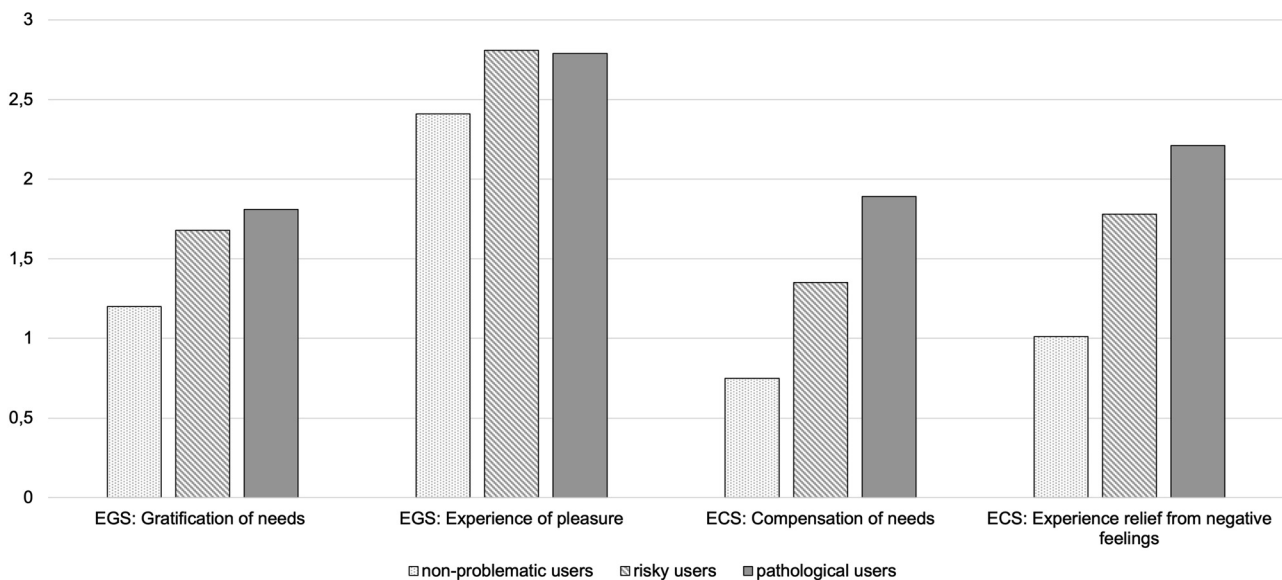


Fig. 1. Illustration of the experienced gratification and experienced compensation in individuals with non-problematic, risky, and pathological use in the aggregated sample of specific Internet-use disorders

Note. EGS = Experience of Gratification Scale; ECS = Experience of Compensation Scale. * $p < 0.05$.



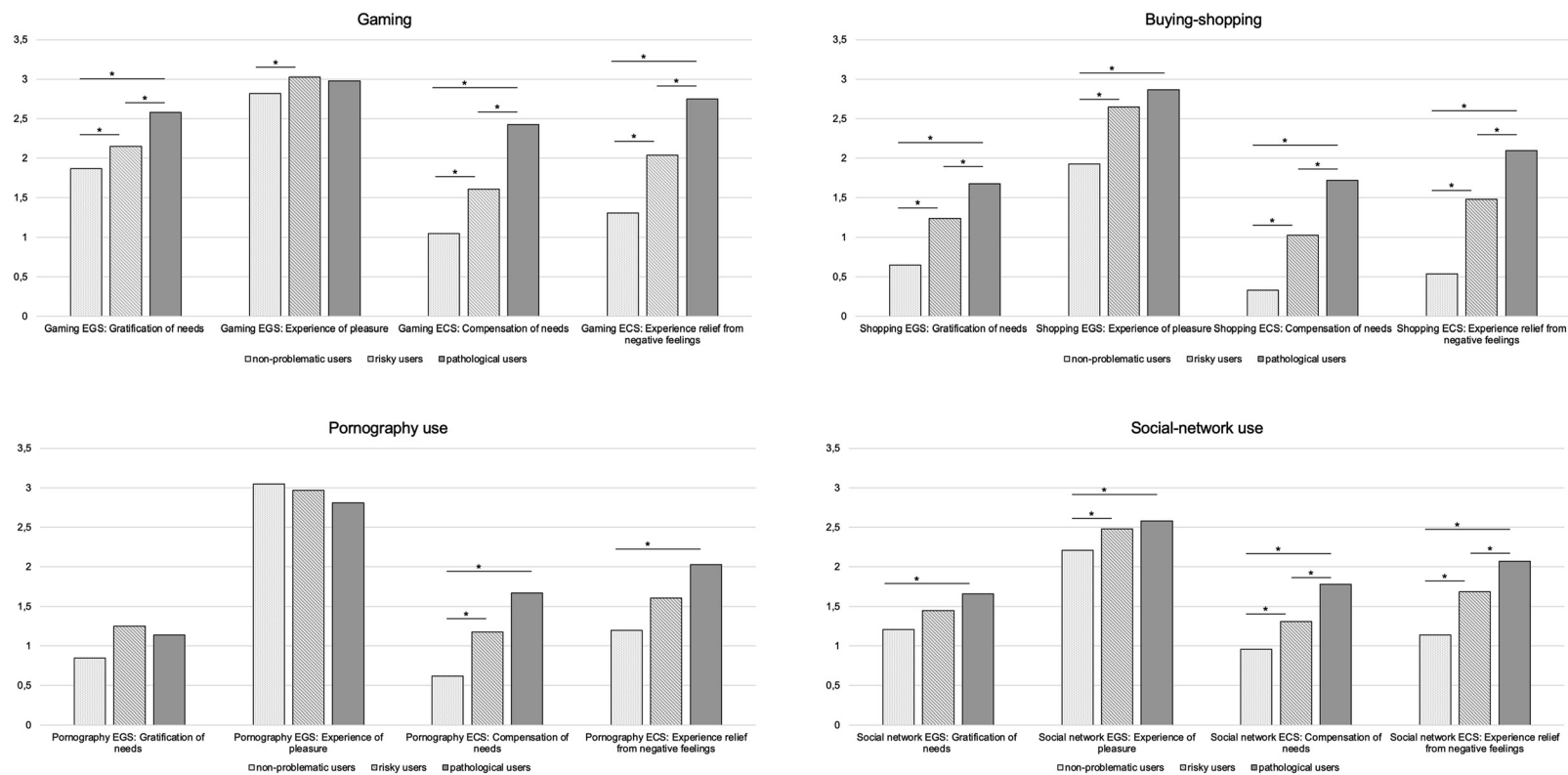


Fig. 2. Illustration of the experienced gratification and experienced compensation in individuals with non-problematic, risky, and pathological use differentiated for gaming, buying-shopping,

online pornography use, and social-network use

Note. EGS = Experience of Gratification Scale; ECS = Experience of Compensation Scale. * $p < 0.05$.



Table 3. Descriptive statistics of experience of gratification and compensation for the specific usage behavior

	Gaming			Buying-shopping			Pornography use			Social-network use		
	Non-problematic	Risky	Pathological	Non-problematic	Risky	Pathological	Non-problematic	Risky	Pathological	Non-problematic	Risky	Pathological
EGS: Gratification of needs	1.87 (0.75)	2.15 (0.74)	2.58 (0.66)	0.65 (0.52)	1.24 (0.75)	1.68 (0.82)	0.85 (0.68)	1.25 (0.99)	1.17 (0.89)	1.21 (0.66)	1.45 (0.68)	1.66 (0.82)
EGS: Experience of pleasure	2.82 (0.56)	3.03 (0.59)	2.98 (0.59)	1.93 (0.85)	2.65 (0.78)	2.87 (0.89)	3.05 (0.80)	2.97 (0.70)	3.02 (0.69)	2.21 (0.55)	2.48 (0.58)	2.58 (0.66)
ECS: Compensation of needs	1.05 (0.76)	1.61 (0.87)	2.43 (0.91)	0.33 (0.59)	1.03 (0.92)	1.72 (1.00)	0.62 (0.62)	1.18 (0.76)	1.71 (0.79)	0.96 (0.71)	1.31 (0.73)	1.78 (0.84)
ECS: Experience relief from negative feelings	1.31 (0.87)	2.04 (0.86)	2.75 (0.86)	0.54 (0.74)	1.48 (0.87)	2.10 (1.08)	1.20 (0.85)	1.61 (0.94)	2.05 (0.97)	1.14 (0.73)	1.69 (0.90)	2.07 (0.85)

Note. Values represent Means and (in brackets) Standard Deviations.

Bivariate correlations

We analyzed relationships between the experienced gratification and experienced compensation and related constructs such as symptom severity, use expectancies, and self-reported habit tendencies. It could be emphasized that experienced gratification and experienced compensation were significantly correlated with the constructs mentioned. Symptom severity assessed with the ACSID-11 showed low positive correlations with EGS but moderate positive correlations with ECS subscales. Highest effect sizes can be found between EGS subscales and positive use expectancies as well as between ECS subscales and avoidance use expectancies. Self-reported habit tendencies negatively correlated with all subscales with low effect sizes (see Table 4.)

The bivariate correlations between gratification of needs, experience of pleasure, compensation of needs, and experience of relief from negative feelings, and specific usage motives for the different types of online behavior also indicated significant correlation patterns. Overall, the positive correlations with small to moderate effect sizes indicate a relationship between motivational aspects why using a specific application and anticipated experiences when showing a specific behavior. Only among individuals using online pornography, we found no significant relationships which might be affected by the sample size (see Table 5).

DISCUSSION

We investigated the relevance of experienced gratification and experienced compensation in individuals with non-problematic, risky, and pathological online behaviors classified by a standardized diagnostic interview based on DSM-5 criteria. The results illustrate significant differences in individuals with pathological and at-risk symptoms showing higher degrees of experience of gratification assessed by both subscales (gratification of needs and experience of pleasure) compared to the group of non-problematic use. In contrast to the postulated “shift-hypothesis” of the I-PACE model, we did not find a reduced experience of gratification in individuals with pathological use measured by both subscales (gratification of needs and experience of pleasure) as well. Individuals with pathological use showed highest experiences of compensation compared to risky and non-problematic use. More clearly than in the case of the experienced gratification, the experienced compensation was more strongly associated with symptom severity. The results fit with the alternative hypothesis of the “feels-better” pathway that both positive and negative reinforcement mechanisms play a crucial role in addictive behaviors in early and later stages. However, it must be mentioned that the early and later stages were only measured indirectly, as this is a cross-sectional design and not a long-term approach. As a result, we were only able to compare the severity of the symptoms to obtain information about the relevance of the development of these components in the addiction process.



Table 4. Bivariate correlations between the factors of both scales EGS and ECS and the applied scales for the aggregated sample

	<i>Cronbachs Alpha</i>	<i>M (SD)</i>	EGS: Gratification of needs	EGS: Experience of pleasure	ECS: Compensation of needs	ECS: Experience of relief from negative feelings
ACSID-11 symptoms frequency	0.938	11.25 (8.97)	0.264**	0.198*	0.521**	0.526**
ACSID-11 symptoms intensity	0.934	9.92 (8.49)	0.262**	0.205**	0.520**	0.534**
IUE positive use expectancies	0.887	4.28 (1.09)	0.556**	0.696**	0.387**	0.441**
IUE avoidance use expectancies	0.857	3.33 (1.41)	0.403**	0.279**	0.655**	0.651**
SRHI self-report habit ¹	0.951	4.17 (0.90)	−0.119**	−0.135**	−0.164**	−0.165**

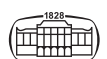
***p* < 0.01.

¹ For the SRHI, higher values indicate lower habitualized behavior.

Table 5. Bivariate correlations between the factors of both scales EGS and ECS and specific usage motives for the different types of online behavior

		<i>n</i>	<i>Cronbachs Alpha</i>	<i>M (SD)</i>	EGS: Gratification of needs	EGS: Experience of pleasure	ECS: Compensation of needs	ECS: Experience of relief from negative feelings
Gaming as target behavior	MOGQ Social	272	0.851	2.28 (1.03)	0.453**	0.239**	0.251**	120*
	MOGQ Escape	272	0.905	2.45 (1.08)	0.368**	0.170**	0.632**	0.680**
	MOGQ Competition	272	0.881	2.85 (1.10)	0.324**	0.086	0.229**	0.235**
	MOGQ Coping	272	0.774	2.77 (0.83)	0.410**	0.421**	0.499**	0.507**
	MOGQ Skill Development	272	0.909	2.33 (1.11)	0.393**	0.290**	0.183**	0.181**
	MOGQ Fantasy	272	0.863	2.22 (1.10)	0.428**	0.271**	0.474**	0.473**
	MOGQ Recreation	272	0.750	4.09 (0.79)	0.252**	0.558**	0.048	0.083
	Buying-shopping as target behavior	ISUEQ	246	0.831	2.16 (1.00)	0.291**	0.233**	0.403**
Anonymously		246	0.793	3.83 (0.85)	0.419**	0.509**	0.382**	0.433**
ISUEQ Variety		246	0.889	2.47 (1.19)	0.622**	0.636**	0.676**	0.714**
Pornography use as target behavior	Immediate pos. feelings							
	PCI Emotional	84	0.888	14.21 (5.57)	0.006	−0.119	0.481**	0.428**
	Avoidance	84	0.887	11.20 (4.35)	0.306**	0.215**	0.024	0.065
	PCI Sexual Curiosity	84	0.542	9.16 (2.63)	0.395**	0.233*	0.254**	0.461**
	Seeking	84	0.556	12.30 (2.12)	0.133	0.484**	0.079	0.222*
Social-network use as target behavior	Pleasure	84	0.771	46.87 (8.97)	0.299**	0.213	0.404**	0.485**
	PCI Overall	84	0.782	3.94 (0.77)	0.223*	0.390**	0.319**	0.442**
	MUSM	232	0.519	2.87 (0.74)	438**	0.223**	0.255**	0.264**
	Entertainment	232	0.622	3.81 (0.76)	0.238**	0.213**	0.174**	0.156*
	MUSM Personal	232	0.514	3.21 (0.91)	0.474**	0.291**	0.369**	0.364**
	Utility	232	0.606	2.13 (0.88)	0.312**	0.137*	0.243**	0.193**
	MUSM Altruism	232						

p* < 0.05, *p* < 0.01.



Integrating the results in the theoretical framework of the I-PACE model, they highlight the potential role of gratification in early stages and the increase of compensation during the addiction development (Brand et al., 2019). However, the results of our study do not support a shift from gratification in earlier to compensation in later stages as experience of gratification was comparably high in individuals with risky use (reflecting earlier stages) and individuals with pathological use (reflecting later stages). Rather, no shift seems to take place, but in addition to the increase in experienced gratification as positive reinforcement mechanism, the experienced compensation is added as a further part of the feels-better pathway. With a critical view on the I-PACE model, this means that positive and negative reinforcement mechanisms should be equally dominant in the later stages. Regarding the feels-better pathway, it can also be specified that both reinforcement mechanisms do not appear to be equally involved at the beginning, but that negative reinforcement mechanisms are added after the more rewarding experiences, possibly with the aim of achieving a desired state. Both theoretical assumptions could therefore be specified based on these results. With regard to the further behavioral manifestation, it can now also be argued that the must-do pathway postulated by Brand (2022) could develop from the negative reinforcement and thus possibly a compulsive facet is only included at this point in the pathological behavior, which may represent a differentiation from other mental disorders such as obsessive-compulsive-disorders.

Considering the neural correlates, research also indicates that gratification and compensation might be processed via different neural pathways. For example, it has been discussed that GABAergic neurons along the medial forebrain could drive positive reinforcement, while glutamatergic neurons might drive negative reinforcement (Gordon-Fennell & Stuber, 2021). Other works suggest that positive and negative reinforcement are both driven by dopaminergic neurons coding violations in expectations (outcome expected vs. outcome received), called reward prediction error (Gentry, Schuweiler, & Roesch, 2019; Piantadosi, Halladay, Radke, & Holmes, 2021). Following this theory on prediction errors, a better outcome as expected is coded by an increase in firing of dopaminergic neurons and dopamine release within the ventral tegmental area. A worse outcome than expected is coded by a reduced firing of these dopaminergic neurons. Again, the assumptions on prediction errors fit with the consideration of a “feels-better” pathway (Brand, 2022) that processes both positive, rewarding and negative, relief reinforcement mechanisms. When considering neural changes in the development of behavioral addictions it might be important to investigate to which degree the experienced gratification and compensation deviate from expected rewards and how these relate to neural processing within the VTA and ventral striatum.

On an exploratory level, results revealed significant differences between gaming, buying-shopping, pornography, and social-network use in terms of experienced gratification and compensation, although these results must be treated

with caution given the different sample sizes across the usage types. The gaming group showed highest experienced gratification and experienced compensation followed by individuals with pornography use, social-network use, and online buying-shopping. Nevertheless, the results consistently showed that experienced gratification and experienced compensation play a decisive role for individuals with pathological Internet use. Specific differences between the behaviors could be observed selectively but must be examined in the future regarding possible differences between the individual behaviors such as sociodemographic differences, usage patterns, or actual experiences during usage. Moreover, the strengths of reported experiences of gratification and compensation may also be associated with a difference in the relevance of emotions or general need satisfaction in everyday life. Studies have emphasized the importance of emotion regulation strategies in disordered Internet use (e.g., Gioia, Rega, & Boursier, 2021; Giordano, Schmit, & McCall, 2023), and it may be that addressing pathological behavior is precisely a matter of focusing more strongly on this striving for need satisfaction or the compensation of negative emotions with alternative strategies or coping mechanisms.

Considering the relationship to associated constructs, experienced gratification and experienced compensation were correlated with symptom severity, use expectancies, self-reported habit tendencies, and specific usage motives. Both mechanisms showed positive associations with symptom severity, but the experience of compensation to a greater extent than experience of gratification. In addition, the juxtaposition of positive and negative constructs is also reflected in use expectancies and illustrate the strong link between expectations and experience without being completely identical. While use expectancies are more associated with motivational characteristics, experiences during the usage are more related with emotional aspects directly related to use itself rather than with the anticipation of potential consequences of the use. For self-reported habit tendencies, we found significant negative correlations. Thus, it appears that stronger experiences of gratification and compensation are associated with higher habitualized behavior. This is in line with the idea that gratification and compensation contribute to instrumental learning mechanisms and habits (Antons et al., 2023). Regarding usage motives, we found significant correlations with behavior-specific usage motives and both, experienced gratification and compensation indicating in general usage motives are related with the experiences of satisfying motives and needs or of compensating unsatisfied desires even if we assume that motives reflect a basic interest in using a specific application and are less strongly associated with the addiction process. Only motives that address the need to deal with negative emotions, which is also found in the conceptualization of compensation, seem to be an exception.

Nevertheless, we may mention some strengths and limitations. A clear strength of the study is the large sample size of individuals with relevant and systematically diagnosed types of (potential) specific Internet-use disorders based on a structured diagnostic interview. However, the sample sizes of the different

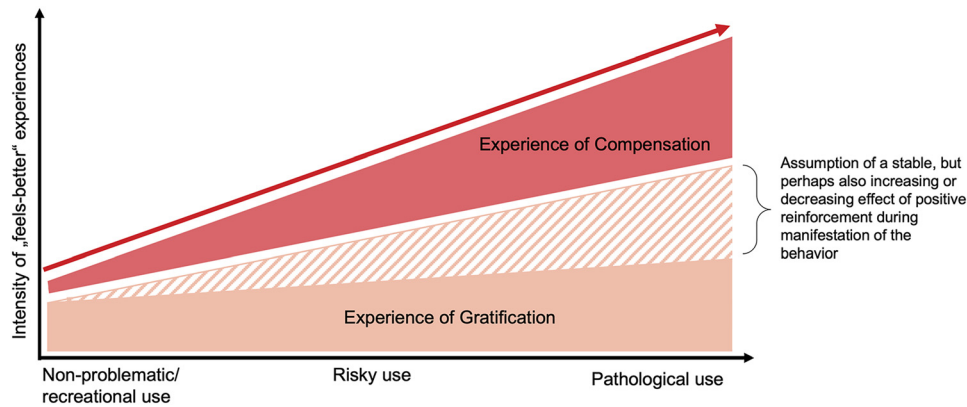


Fig. 3. Visual summary of the current results and extending the theoretical considerations: for non-problematic or risky use, potentially indicating the beginning of the addiction process, the experience of gratification plays a dominant role, which continues to be relevant even for pathological use, potentially indicating later stages of the addiction development. Experiences of gratification, however, may remain the same or even increase or decrease. Moreover, in this process, the feels-better may additionally include compensation to a high amount

specific types of Internet-use disorder differ and gender distribution is not equal. Future studies should strive for a greater balance regarding sociodemographic variables in the specific disorders, even if these did not show any significant effects, to make a stronger statement regarding the generalizability of the effects. Moreover, we highly recommend the implementation of longitudinal approaches to better understand the changes and the relevance of certain mechanisms within the addiction process. In the cross-sectional design of the present study, early and later stages could only be measured indirectly through the identification of risky and pathological behaviors. In addition, within the current study, we also measured anticipated experiences of gratification and compensation providing first insights, however, studies are needed which investigate the current experiences of emotions and feelings directly while using or directly after the use of the preferred online applications (and not retrospectively). Combining both approaches (longitudinal and current experiences) would gain important knowledge in the relevance of gratification and compensation as key constructs of the development and maintenance of addictive behaviors.

In conclusion, the current results are an important addition to the results by Wegmann et al. (2022). By identifying different user groups with varying symptom severity, the potential importance of experienced gratification and compensation in the development of addictive behaviors could be emphasized. Individuals with a pathological use experience stronger gratification and compensation of negative emotions showing the preferred online behavior (see Fig. 3). On a theoretical level, the findings contribute to the discussion of the development of positive and negative reinforcement during the addiction process leading to the consideration that instead of a shift of these mechanisms the persistent, or additional impact of both might be more appropriate.

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Conflict of interest: Stephanie Antons and Matthias Brand serve as associate editors to the Journal of Behavioral Addictions. The authors declare no conflict of interest regarding the current manuscript.

SUPPLEMENTARY MATERIAL

Supplementary data to this article can be found online at <https://doi.org/10.1556/2006.2024.00067>.

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