Journal of Technology in Behavioral Science
https://doi.org/10.1007/s41347-025-00489-z

Distress Tolerance as a Risk Factor for Specific Internet-Use Disorders

Yuan Chong Hew[1] · **Peter K. H. Chew**[1]

Received: 13 September 2024 / Revised: 22 September 2024 / Accepted: 30 January 2025
© The Author(s) 2025

Abstract
Existing research on distress tolerance has focused on non-technological addictions and general Internet addiction; however, none explored its association with specific Internet-use addictions. This study aimed to investigate whether distress tolerance could be a risk factor for three specific Internet-use disorders: Internet gaming disorder (IGD), problematic social media use (PSMU), and problematic pornography use (PPU) guided by the interaction of person-affect-cognition-execution (I-PACE) model. As emotional regulation and distress tolerance are related but distinct constructs, emotional regulation was controlled in the current study. It was hypothesized lower distress tolerance would predict higher severity in IGD (H1), PSMU (H2), and PPU (H3) after controlling for demographics (i.e., age and gender) and emotional regulation. Upon ethics approval from the university's human research ethics committee, 151 participants (62.9% females; mean age = 27.35, *SD* = 6.41) were recruited. Participants completed scales on distress tolerance, emotional regulation, IGD, PSMU, and PPU. Hierarchical multiple regression was conducted thrice for each outcome variable, with demographics entered in Model 1, emotional regulation subscales entered in Model 2, and distress tolerance subscales entered in Model 3. Results revealed lower distress tolerance significantly predicted higher severity in IGD above and beyond demographics and emotional regulation, but not for PSMU and PPU. This suggests distress tolerance may be a more relevant risk factor for IGD than PPU and PSMU. Limitations pertain to lack of comprehensiveness measuring psychological distress. Longitudinal studies are recommended for future research.

Keywords Distress tolerance · Internet gaming disorder · Problematic social media use · Problematic pornography use · Emotional regulation

Mounting evidence links compulsive use of Internet applications to negative health consequences (Brand, 2022). Among these, Internet gaming disorder stands out, with a global prevalence estimated at 3.05%, comparable to substance-use and compulsive disorders (Stevens et al., 2020). Due to this, Internet gaming disorder was recognized in the *Diagnostic and Statistical Manual of Mental Disorders* (5th ed., text rev.; *DSM-5-TR*; American Psychiatric Association [APA], 2022) as a condition warranting further study. IGD is characterized by a pattern of excessive Internet gaming that results in symptoms related to progressive loss of control over gaming, tolerance, and withdrawal symptoms (APA, 2022). The criteria include (1) preoccupation with games, (2) withdrawal symptoms like irritability when unable to play games, (3) increased tolerance, the need to increase time spent on games, (4) unsuccessful attempts to reduce or stop gaming, (5) loss of interest in other activities because of gaming, (6) continued gaming despite concerns, (7) deceiving family members or others about the amount of gaming, (8) gaming to escape negative moods, and (9) risk or loss of a relationship, job, or educational or career opportunity because of gaming. Individuals who meet more than five criteria during the past 12 months would meet the criteria for IGD. Concurrently, this consideration has also generated awareness about other specific Internet-use disorders, such as problematic social media use (Brand et al., 2016), which are not yet formally recognized in the *DSM-5-TR* (APA, 2022).

✉ Yuan Chong Hew
yuanchong.hew@outlook.com

Peter K. H. Chew
peter.chew@jcu.edu.au

[1] James Cook University, Singapore Campus, Singapore, Singapore

Published online: 13 February 2025

The Interaction of Person Affect Cognition Execution (I-PACE) Model

Motivated by the growing evidence of negative consequences associated with specific Internet-use disorders, the scientific community has focused on developing frameworks to understand how they develop and persist (Brand et al., 2016). One such theoretical model that has garnered significant acclaim is the interaction of person-affect-cognition-execution (I-PACE) model (Brand et al., 2016). One aim of the I-PACE model is to identify risk factors (i.e., core characteristics) of specific Internet-use disorders (Brand et al., 2016). While these components were thoughtfully integrated to summarize the most updated literature to consider I-PACE risk factors, it remains unclear what other relevant risk factors are unaccounted for in the model. Since the publication of the I-PACE model, there has only been one attempt by Brandtner et al. (2021) to propose the variable, desire thinking, as a new moderator for the model. Given that individuals with lower distress tolerance (i.e., the ability to withstand negative emotional states) experience a lower threshold for aversive states and tend to perceive negative situations as more severe, it can be argued individuals with lower distress tolerance may be motivated to seek out activities on the Internet to avoid stress and experience immediate gratification (e.g., completing an in-game mission; Simons & Gaher, 2005; Zvolensky et al., 2010). Interestingly, previous research also found that individuals with lower distress tolerance are likely to experience impaired modulation of catecholamine due to frequent stress, leading to compromised executive functions like working self-control (Girotti et al., 2018; Young & Brand, 2017). This further suggests that individuals with lower distress tolerance are more susceptible to repeated engagement in problematic behaviors on the Internet because they might struggle with resisting temptations. For these reasons, individuals with lower distress tolerance are likely to develop compulsivity towards problematic behaviors, thereby, developing and maintaining specific Internet-use disorders (Fig. 1).

Distress Tolerance and Specific Internet-Use Disorders

Extant literature investigating distress tolerance its relationship with specific Internet-use disorders as a standalone construct has been largely ignored (Gu, 2022; Yang et al., 2022). Specifically, although a few studies have explored the impact of distress tolerance on technology use, specific Internet-use disorders were regarded as general Internet use (Gu, 2022; Sánchez-Fernández & Borda-Mas, 2022; Skues et al., 2015; Zaorska et al., 2023). For example, Gu (2022) found that lower distress tolerance predicted a higher likelihood of problematic Internet use. Problematic Internet use in this context views Internet activity as a unit rather than an umbrella of specific behaviors. This approach to studying specific Internet-use disorders is problematic as it overlooks the Internet's role as a medium facilitating various activities and discounts the nuances associated with technology-related addiction. After excluding research on general Internet use, our review of the literature reveals only one study that investigated the effect of distress tolerance on specific Internet-use disorders. However, Yao et al. (2023) adapted the Smartphone Addiction Scale-Short Version to measure problematic TikTok use. As Griffiths et al. (2014) argue, scales such as the proposed Problematic TikTok Use Severity (Yao et al., 2023) risk relating addiction to a commercial company's services rather than a specific activity (e.g., social networking). With these considerations combined, the direct effect of how distress tolerance can be a risk factor of specific Internet-use disorders in the development of IGD, PSMU, and PPU remains unexplored.

The Current Study

The current study aimed to provide preliminary evidence on the relationship between distress tolerance and specific Internet-use disorders in two key areas. First, this study aimed to cohesively explain distress tolerance as a risk factor in a comprehensive addiction framework like the I-PACE model. Second, this study aimed to examine the direct effect of distress tolerance on IGD, PSMU, and PPU. It is noteworthy existing literature for distress tolerance can be categorized into two main groups: those that explore distress tolerance as a standalone construct (e.g., Zvolensky et al., 2010) and those that subsumed distress tolerance under emotional regulation (e.g., Linehan, 1993; Naragon-Gainey et al., 2017). As distress tolerance and emotional regulation are related but distinct, emotional regulation would be controlled in the current study (Jeffries et al., 2015). In other words, this study considered distress tolerance a standalone construct. It was therefore hypothesized that lower distress tolerance predicts increased severity of the three specific Internet-use disorders after controlling for emotional regulation and demographics (i.e., age and gender). Specifically, as the scores for the four distress tolerance subscales (i.e., tolerance, appraisal, absorption, and regulation) decreases, IGD (H1), PSMU (H2), and PPU (H3) increases after controlling emotional regulation subscales (i.e., non-acceptance, goals, strategies, clarity, awareness, and impulsivity) and demographics.

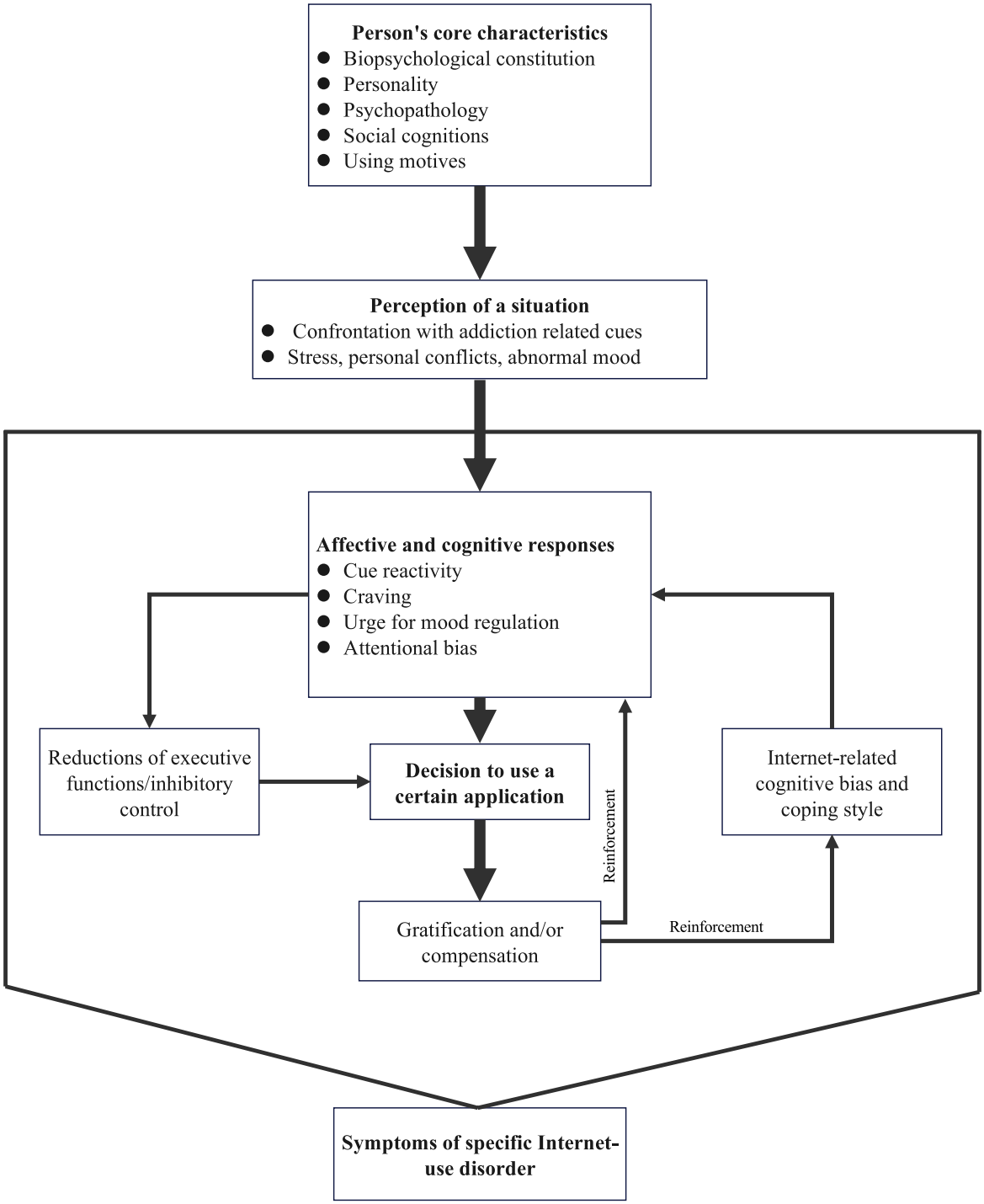

Fig. 1 Interaction of Person Affect Cognition Execution (I-PACE) Model. Note. This model was adopted from Young and Brand (2017), a reduced version of the I-PACE model developed by Brand et al. (2016). Bolded arrows represent main pathways of addiction

Methods

Participants

A convenience and snowball sample of 166 participants was initially recruited. Upon cleaning the data, 15 participants were removed due to minimal gender representation (i.e., non-binary), attrition, and multivariate outliers (Dong & Peng, 2013; Little, 1988). The final sample size was 151. Their age ranged from 18 to 51 years old (62.9% females; mean age = 27.35, $SD = 6.41$). Given the rule of thumb for $N > = 104 + m$ (where m = number of predictors; Green,

1991), with 12 predictors in the current study, the sample size exceeded the required number of 116 participants.

Instruments

Distress Tolerance Scale

The 15-item Distress Tolerance Scale (DTS) measures challenges in tolerating emotional distress (Simons & Gaher, 2005). The scale utilizes a 5-point Likert scale, with responses: strongly agree (1), mildly agree (2), equally disagree and agree (3), mildly disagree (4), and strongly disagree (5). The scale measures four subscales: tolerance (e.g., "I can't handle being distressed or upset"), absorption (e.g., "My feelings of distress are so intense that they completely takeover"), appraisal (e.g., "My feeling of distress or being upset are unacceptable"), and regulation (e.g., "I'll do anything to avoid feeling distressed or upset"). Negatively worded items were reverse-coded. The item scores of each subscale were summed, with higher scores indicating greater ability to tolerate distress. The tolerance subscale score ranges from 3 to 15, the appraisal subscale score ranges from 6 to 30, the absorption subscale score ranges from 3 to 15, and the regulation subscale score ranges from 3 to 15. The four-factor structure has been supported by exploratory and confirmatory factor analysis (Simons & Gaher, 2005). The subscales have acceptable internal consistencies of 0.75 (tolerance), 0.79 (appraisal), 0.82 (absorption), and 0.73 (regulation; Hsu et al., 2023).

Difficulties in Emotional Regulation Scale

The 36-item Difficulties in Emotional Regulation Scale (DERS) measures challenges in regulating emotions (Gratz & Roemer, 2004). The scale utilizes a 5-point Likert scale, with responses: almost never (1), sometimes (2), about half the time (3), most of the time (4), and almost always (5). The scale measures six subscales: non-acceptance (e.g., "When I am upset, I become angry with myself for feeling that way"), goals (e.g., "When I'm upset, I have difficulty focusing on other things"), impulse (e.g., "When I'm upset, I feel out of control"), strategies (e.g., "When I'm upset, I believe that I will remain that way for a long time"), awareness (e.g., "I pay attention to how I feel"), and clarity (e.g., "I have no idea how I am feeling"). Negatively worded items were reverse-coded. The item scores for each subscale were summed, with higher scores indicating greater difficulties in emotional regulation. The non-acceptance subscale score ranges from 6 to 30, the goals subscale score ranges from 6 to 25, the impulse subscale score ranges from 6 to 30, the awareness subscale score ranges from 6 to 30, the strategies subscale score ranges from 8 to 40, and the clarity subscale score ranges from 5 to 25. The six factors structure of the instrument has been supported by exploratory factor analysis with good internal consistencies of 0.85 (nonacceptance), 0.89 (goals), 0.86 (impulse), 0.80 (awareness), 0.88 (strategies), and 0.84 (clarity; Gratz & Roemer, 2004).

Internet Gaming Disorder Scale-Short-Form

The nine-item Internet Gaming Disorder Scale-Short-Form (IGDS9-SF) measures the severity of IGD and its detrimental effects by examining both offline and/or online gaming activities (e.g., "Do you systematically fail when trying to control or cease your gaming activity?"; Pontes & Griffiths, 2015). The scale utilizes a 5-point Likert scale: never (1), rarely (2), sometimes (3), often (4), and very often (5). The item scores were summed, with higher scores indicating higher severity of Internet gaming disorder symptoms. Scores for the instrument range from 9 to 45. The unidimensional scale has been supported by exploratory and confirmatory factor analysis (Pontes & Griffiths, 2015). Additionally, it has demonstrated good internal consistency (Cronbach alpha of 0.87; Pontes & Griffiths, 2015).

Bergen Social Media Addiction Scale

The six-item self-reported Bergen Social Media Addiction Scale (BSMAS) measures core addiction elements in the use of social media (e.g., "How often have you tried to cut down on the use of social media without success?"; Andreassen et al., 2016). The scale utilizes a 5-point Likert scale: very rarely (1), rarely (2), sometimes (3), often (4), and very often (5). The item scores were summed, with higher scores indicating a higher severity of problematic social media use. The scores for the instrument range from 6 to 30. The unidimensional scale has been supported by confirmatory factor analysis (Zarate et al., 2023). Furthermore, the scale has demonstrated good internal consistency (Cronbach alpha of 0.88; Andreassen et al., 2016).

Problematic Pornography Consumption Scale

The 18-item Problematic Pornography Consumption Scale (PPCS) was used to measure problematic Internet pornography use (Bőthe et al., 2018). The scale measures six components of addiction: salience (e.g., "I felt that porn is an important part of my life"), mood modification (e.g., "I used porn to restore the tranquility of my feelings"), conflict (e.g., "I felt that porn caused problems in my sexual life"), tolerance (e.g., "I felt that I had to watch more and more porn for satisfaction"), relapse (e.g., "I unsuccessfully tried to reduce the amount of porn I watch"), and withdrawal (e.g., "I became stressed when something prevented me from watching porn"). The PPCS utilizes a 7-point Likert scale: never (1), never (2), rarely (3), occasionally (4), often (5), very often (6), all the time (7). The item scores were summed, with higher scores indicating higher severity of problematic pornography use. Scores for the instrument range from 18 to 126. The six-factor solution has been supported by confirmatory

factor analysis and the overall scale has good internal consistency (Cronbach alpha of 0.93; Bőthe et al., 2018).

Procedure

First, participants accessed the study through a QR code or link. After accessing the study, participants were invited to read the information sheet before providing consent. Participants were informed they would be able to leave the study at any given time, and the study could take up to 30 min. Participants who did not provide consent discontinued the study and were directed to the end of the survey. Subsequently, participants who had consented were directed to complete the demographics form, which consisted of questions about their age, gender, level of education, and nationality. Participants then completed the DTS, DERS, IGDS9-SF, BSMAS, and PPCS respectively. This procedure was approved by the university's human research ethics committee (Approval number: H9345).

Data Analysis

SPSS version 29 was used to conduct the analyses. Before the main analyses, a missing value analysis was conducted (Dong & Peng, 2013). Data was found to be missing completely at random, and missing values were imputed ($p = 0.051$; Dong & Peng, 2013; Little, 1988). Pearson correlation analysis was conducted to determine the size and direction of the linear relationship between the 15 variables. Descriptive statistics were obtained by running descriptives and explore on the 15 variables. Subsequently, reliability analysis was conducted using the four DTS subscales, six DERS subscales, IGDS9-SF, PPCS, and BSMAS to determine the reliability of the scales. Next, hierarchical multiple regression analysis was conducted thrice to determine if the distress tolerance subscales would explain a statistically significant amount of variance in IGDS9-SF, BSMAS, and PPCS respectively after controlling for demographics (i.e., age and gender) and the emotional regulation subscales. For each outcome variable, demographics were entered in Model 1. In Model 2, the six DERS subscales were entered to estimate the amount of unique variance accounted above and beyond demographics. In Model 3, the four DTS subscales were entered to estimate the amount of unique variance accounted above and beyond DERS and demographics.

Results

Table 1 presents descriptives and intercorrelations of respective questionnaires with alpha level set at 0.05. Overall, the DTS subscales were negatively correlated with the DERS subscales but close to half of the correlations were weak (i.e., $r = < 0.50$). IGDS9-SF, BSMAS, and PPCS were negatively correlated with DTS subscales and positively correlated with DERS subscales. Additionally, males were associated with higher scores in PPCS and IGDS9-SF, but females were associated with higher scores in BSMAS. Lastly, younger age was associated with higher scores in BSMAS and IGDS9-SF, but older age was associated with higher scores in PPCS.

Assumptions Testing

Assumptions testing found no violations for independence of errors, homoscedasticity, multicollinearity, and linearity. However, the assumption for normality was violated, as Shapiro–Wilk was significant for most variables (i.e., only the DTS subscales and the DERS subscales were non-significant), positive histograms skews were observed in several DERS subscales (i.e., clarity, strategies, impulse, and non-acceptance), PPCS, and IGDS9-SF. Furthermore, several univariate outliers were identified in PPCS, IGDS9-SF, and some DERS subscales (i.e., clarity, awareness, impulse, non-acceptance). Nevertheless, the univariate outliers and normality violations were not flagged as concerns as they were considered genuine responses from a large, healthy sample of individuals with a subset of clinical population. Additionally, before running hierarchical regression, one multivariate outlier identified using Mahalnobis distance was removed.

Internet Gaming Disorder

In Model 1, predictors age and gender (males = 1, females = 2) collectively accounted for a non-significant 2.90% of the variance in IGDS9-SF, $F(2, 148) = 2.22$, $p = 0.112$. In Model 2, inclusion of the DERS subscales collectively accounted for a significant 18.50% of the variance in IGDS9-SF, $F(8, 142) = 4.03$, $p < 0.001$. The ΔR^2 of 15.60% between the two models was significant, $\Delta F(6, 142) = 4.52$, $p < 0.001$. When the DTS subscales were entered in Model 3, the variables collectively accounted for a significant 24.20% of the variance in IGDS9-SF, $F(12, 138) = 3.66$, $p = < 0.001$. The ΔR^2 of 5.70% between the two models was significant, $\Delta F(4, 138) = 2.58$, $p = 0.040$. For individual predictors, gender, $b = -0.20$, $SE = 1.14$, $t = -2.63$, $p = 0.010$, was significant after controlling for other predictors, with males associated with higher severity in IGDS9-SF (see Table 2). Similarly, tolerance, $b = -0.35$, $SE = 0.30$, $t = -2.91$, $p = 0.004$, was significant after controlling for other predictors, with lower tolerance associated with higher severity in IGDS9-SF.

Problematic Social Media Use

In Model 1, predictors age and gender (males = 1, females = 2) collectively accounted for a significant 14.60% of the variance

Table 1 Descriptives and intercorrelations of demographics, DERS subscales, DTS subscales, IGDS9-SF, BSMAS, and PPCS

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Gender	–														
2. Age	−0.17*	–													
DERS															
3. NA	0.05	−0.31**	–												
4. Goals	0.17*	−0.08	0.41**	–											
5. Impulse	0.22**	−0.16	0.45**	0.64**	–										
6. Awareness	0.006	0.004	0.22**	0.10	0.30**	–									
7. Strategies	0.18*	−0.20*	0.62**	0.63**	0.75**	0.28**	–								
8. Clarity	0.10	−0.24**	0.44**	0.32**	0.52**	0.52**	0.50**	–							
DTS															
9. Tolerance	−0.12	0.12	−0.31**	−0.40**	−0.60**	−0.19*	−0.52**	−0.36**	–						
10. Appraisal	−0.06	0.15	−0.63**	−0.43**	−0.64**	−0.30**	−0.70**	−0.49**	0.65**	–					
11. Absorption	−0.18*	0.26**	−0.55**	−0.59**	−0.66**	−0.20*	−0.72**	−0.41**	0.70**	0.69**	–				
12. Regulation	−0.01	0.08	−0.34**	−0.17*	−0.32**	−0.07	−0.24**	−0.20*	0.38**	0.46**	0.30**	–			
SIUD															
13. IGDS9-SF	−0.11	−0.11	0.16*	0.19*	0.33**	0.26**	0.27**	0.30**	−0.37**	−0.24**	−0.28**	−0.08	–		
14. BSMAS	0.23**	−0.34**	0.28**	0.41**	0.51**	0.13	0.48**	0.35**	−0.39**	−0.35**	−0.41**	−0.21**	0.32**	–	
15. PPCS	−0.45**	0.03	0.22**	0.07	0.08	0.12	0.13	0.12	−0.10	−0.14	−0.08	−0.06	0.41**	0.10	–
M	1.63	27.35	13.52	14.53	12.65	14.54	18.44	11.30	9.23	20.40	8.79	8.56	16.02	15.79	34.07
SD	0.49	6.41	5.36	4.84	4.61	4.75	6.69	3.94	2.86	5.34	3.00	2.96	7.12	5.59	20.73
Cronbach's alpha	–	–	0.87	0.89	0.86	0.83	0.89	0.87	0.73	0.84	0.82	0.79	0.92	0.87	0.97

$N = 151$. Gender was coded as 1 = male, 2 = female; *SIUD* specific Internet-use disorders; *DERS* Difficulties in Emotional Regulation Scale; *NA* non-acceptance; *DTS* Distress Tolerance Scale; $p < 0.05$*, $p < 0.01$**

Table 2 The relationship between distress tolerance and IGD after controlling for demographics and emotional regulation

Model	*B*	*SE*	95% CI		*Beta*	*t*	*p*
			LL	*UL*			
Model 1							
Age	−0.15	0.09	−0.33	0.03	−0.13	−1.62	0.108
Gender	−1.94	1.21	−4.32	0.45	−0.13	−1.61	0.110
Model 2							
Age	−0.11	0.09	−0.29	0.08	−0.10	−1.16	0.249
Gender	−2.92	1.16	−0.21	−0.62	−0.20	−2.51	0.013
DERS non-acceptance	−0.11	0.14	−0.37	0.16	−0.08	−0.78	0.439
DERS goals	0.003	0.15	−0.31	0.30	−0.002	−0.02	0.985
DERS impulsivity	0.41	0.20	0.03	0.80	0.27	2.11	0.036
DERS awareness	0.21	0.14	−0.06	0.48	0.14	1.53	0.129
DERS strategies	0.06	0.15	−0.23	0.34	0.05	0.39	0.699
DERS clarity	0.16	0.19	−0.21	0.54	0.09	0.87	0.389
Model 3							
Age	−0.09	0.09	−0.27	0.09	−0.08	−0.99	0.327
Gender	−3.00	1.14	−5.26	−0.74	−0.20	−2.63	0.010
DERS non-acceptance	0.02	0.15	−0.27	0.32	0.02	0.15	0.880
DERS goals	−0.04	0.16	−0.34	0.27	−0.02	−0.22	0.823
DERS impulse	0.30	0.21	−0.11	0.71	0.19	1.45	0.150
DERS awareness	0.22	0.13	−0.05	0.48	0.14	1.60	0.111
DERS strategies	0.05	0.16	−0.26	0.36	0.05	0.32	0.747
DERS clarity	0.15	0.19	−0.22	0.52	0.08	0.80	0.423
DTS tolerance	−0.87	0.30	−1.47	−0.28	−0.35	−2.91	0.004
DTS appraisal	0.23	0.19	−0.13	0.60	0.18	1.27	0.208
DTS absorption	0.06	0.33	−0.59	0.71	0.03	0.20	0.846
DTS regulation	0.18	0.21	−0.24	0.59	0.07	0.84	0.403

Gender was coded as 1 = male, 2 = female; *SE* standard error; *CI* confidence interval; *LL* lower limit; *UL* upper limit.

in BSMAS, $F(2, 148) = 12.61$, $p < 0.001$. In Model 2, inclusion of the DERS subscales collectively accounted for a significant 36.30% of the variance in BSMAS, $F(8, 142) = 10.11$, $p < 0.001$. The ΔR^2 of 21.70% between the two models was significant, $\Delta F(6, 142) = 8.06$, $p < 0.001$. For individual predictors, age, $b = -0.25$, $SE = 0.06$, $t = -3.43$, $p = .< 001$, was significant after controlling for other predictors, with younger age associated with higher severity in BSMAS (see Table 3). Similarly, impulse, $b = 0.24$, $SE = 0.14$, $t = 2.14$, $p = 0.034$, was significant after controlling for other predictors, with higher impulse associated with higher severity in BSMAS. When the DTS subscales were entered in Model 3, the variables collectively accounted for a significant 37.80% of the variance in BSMAS, $F(12, 138) = 6.98$, $p = < 0.001$. The ΔR^2 of 1.5% between the two models was non-significant, $\Delta F(4, 138) = 0.83$, $p = 0.507$.

Problematic Pornography Use

In Model 1, predictors age and gender (males = 1, females = 2) collectively accounted for a significant 20.50% of the variance in PPCS, $F(2, 148) = 19.12$, $p < 0.001$. In Model 2, the inclusion of the DERS subscales collectively accounted for a significant 27.20% of the variance in PPCS, $F(8, 142) = 6.64$, $p < 0.001$. The ΔR^2 of 6.70% between the two models was significant, $\Delta F(6, 142) = 2.18$, $p = 0.048$. For individual predictors, gender, $b = -0.48$, $SE = 3.20$, $t = -6.38$, $p = < 0.001$, was significant after controlling for other predictors, with males associated with higher severity in PPCS (see Table 4). When the DTS subscales were entered in Model 3, the variables collectively accounted for a significant 28.20% of the variance in PPCS, $F(12, 138) = 4.53$, $p = < 0.001$. The ΔR^2 of 1.00% between the two models was non-significant, $\Delta F(4, 138) = 0.50$, $p = 0.737$.

Discussion

This was the first study that examined distress tolerance as a risk factor for specific Internet-use disorders. It was hypothesized that lower distress tolerance would predict higher severity in IGD (H1), PSMU (H2), and PPU (H3)

Table 3 The relationship between distress tolerance and BSMAS after controlling for demographics and emotional regulation

Model	*B*	*SE*	95% CI		*Beta*	*t*	*p*
			LL	*UL*			
Model 1							
Age	−0.27	0.07	−0.40	−0.13	−0.31	−3.97	<0.001
Gender	2.11	0.89	0.35	3.87	0.18	2.37	0.019
Model 2							
Age	−0.22	0.06	−0.35	−0.09	−0.25	−3.43	<0.001
Gender	0.95	0.81	−0.65	2.54	0.08	1.17	0.242
DERS non-acceptance	−0.12	0.09	−0.31	0.07	−0.12	−1.27	0.206
DERS goals	0.15	0.11	−0.07	0.36	0.13	1.36	0.175
DERS impulse	0.29	0.14	0.02	0.56	0.24	2.14	0.034
DERS awareness	−0.03	0.10	−0.22	0.16	−0.03	−0.33	0.740
DERS strategies	0.16	0.10	−0.04	0.35	0.19	1.54	0.125
DERS clarity	0.13	0.13	−0.13	0.39	0.09	1.00	0.318
Model 3							
Age	−0.22	0.07	−0.35	−0.09	−0.26	−3.42	<0.001
Gender	0.98	0.81	−0.63	2.58	0.09	1.20	0.232
DERS non-acceptance	−0.10	0.11	−0.31	0.12	−0.09	−0.89	0.374
DERS goals	0.16	0.11	−0.06	0.38	0.14	1.45	0.151
DERS impulse	0.23	0.15	−0.06	0.52	0.19	1.57	0.120
DERS awareness	−0.02	0.10	−0.21	0.17	−0.02	−0.23	0.817
DERS strategies	0.20	0.11	−0.02	0.42	0.24	1.78	0.078
DERS clarity	0.12	0.13	−0.14	0.38	0.09	0.93	0.356
DTS tolerance	−0.30	0.21	−0.73	0.12	−0.16	−1.42	0.157
DTS appraisal	0.09	0.13	−0.17	0.35	0.09	0.68	0.501
DTS absorption	0.19	0.23	−0.28	0.65	0.10	0.80	0.425
DTS regulation	−0.13	0.15	−0.43	0.16	−0.07	−0.90	0.369

Gender was coded as 1 = male, 2 = female; *SE* standard error; *CI* confidence interval; *LL* lower limit; *UL* upper limit.

after controlling for demographics and emotional regulation. However, our findings only supported the prediction for IGD (H1), with lower tolerance in experiences emerging as the most significant predictor for higher IGD severity. Put differently, individuals who report a lower capacity for distress and difficulties coping with emotional discomfort are more likely to experience higher severity in IGD. Contrary to our expectations, lower distress tolerance did not significantly predict higher severity in PSMU (H2) and PPU (H3) after controlling for demographics and emotional regulation. Our results indicate a nuanced perspective on distress tolerance after controlling for emotional regulation. According to the I-PACE model, distinct characteristics can emerge in specific Internet-use disorders despite some shared features (Brand et al., 2016). Specifically, our results suggest distress tolerance might be a more pertinent risk factor for IGD compared to PSMU and PPU.

Our results for H1 are consistent with previous literature associating higher perceived stress levels with the development of IGD (Wang et al., 2023). In addition to perceiving stress more frequently and intensely, our results highlight that individuals less tolerant of distress significantly predicted higher severity in IGD (H1). This association may stem from the instant gratification and emotional avoidance that Internet gaming offers, which provides temporary relief from adverse emotions for those less tolerant of stress (Giardina et al., 2024). Furthermore, the achievement-oriented aspects of most games can provide a sense of accomplishment and control through predictable rewards after completing tasks (Giardina et al., 2024). More importantly, relying excessively on Internet gaming at the expense of adaptive coping mechanisms can lead to negative consequences associated with IGD (e.g., higher aggression), thus highlighting the critical role of distress tolerance as a risk factor of IGD (Li et al., 2023).

Our results for H2 are inconsistent with previous studies that found negative mood states (e.g., boredom) predict higher severity in PSMU (Babiker et al., 2023). This discrepancy suggests that the influence of other factors could outweigh distress tolerance as a risk factor of PSMU. For example, PSMU has been discussed in the context of upward social comparison, leading to lower

Table 4 The relationship between distress tolerance and PPCS after controlling for demographics and emotional regulation

Model	*B*	*SE*	95% CI		*Beta*	*t*	*p*
			LL	*UL*			
Model 1							
Age	−0.17	0.24	−0.65	0.31	−0.05	−0.71	0.481
Gender	−19.63	3.18	−25.91	−13.35	−0.46	−6.17	< 0.001
Model 2							
Age	0.07	0.25	−0.43	0.57	0.02	0.27	0.786
Gender	−20.40	3.20	−26.72	−14.10	−0.48	−6.38	< 0.001
DERS non-acceptance	0.68	0.37	−0.07	1.41	0.17	1.80	0.073
DERS goals	0.06	0.42	−0.78	0.90	0.01	0.14	0.887
DERS impulse	0.17	0.54	−0.90	1.23	0.04	0.31	0.760
DERS awareness	0.20	0.38	−0.54	0.95	0.05	0.54	0.590
DERS strategies	0.15	0.40	−0.64	0.94	0.05	0.37	0.711
DERS clarity	0.14	0.52	−0.89	1.17	0.03	0.27	0.789
Model 3							
Age	0.08	0.26	−0.44	0.59	0.02	0.30	0.766
Gender	−20.55	3.24	−26.95	−14.15	−0.48	−6.35	< 0.001
DERS non-acceptance	0.93	0.42	0.09	1.76	0.24	2.18	0.031
DERS goals	0.04	0.44	−0.83	0.92	0.01	0.10	0.922
DERS impulse	0.15	0.58	−1.00	1.31	0.03	0.26	0.794
DERS awareness	0.21	0.38	−0.54	0.96	0.05	0.55	0.584
DERS strategies	0.26	0.44	−0.61	1.13	0.08	0.59	0.558
DERS clarity	0.14	0.53	−0.90	1.18	0.03	0.26	0.797
DTS tolerance	−1.06	0.85	−2.74	0.63	−0.15	−1.24	0.217
DTS appraisal	0.45	0.52	−0.58	1.48	0.12	0.86	0.391
DTS absorption	0.54	0.93	−1.31	2.38	0.08	0.58	0.566
DTS regulation	0.25	0.15	−0.92	1.42	0.04	0.42	0.676

Gender was coded as 1 = male, 2 = female; *SE* standard error; *CI* confidence interval; *LL* lower limit; *UL* upper limit.

self-esteem (Schivinski et al., 2020). To counteract these stressful feelings, individuals may participate in PSMU to seek social validation through engagement metrics (e.g., likes; Schivinski et al., 2020). As such, it is plausible that risk factors like loneliness may exert a stronger influence on PSMU than distress tolerance (Babiker et al., 2023). Nonetheless, although our findings did not reach significance after controlling for demographics and emotional regulation, our results provide some support that distress tolerance is associated with PSMU. This is evidenced by statistically significant weak to moderate correlations between the distress tolerance subscales and PSMU (see Table 1).

Our non-significant results for H3 and non-significant weak correlations between distress tolerance and PPU (see Table 1) suggest that they are not directly related. This is inconsistent with previous literature that suggests individuals experiencing higher levels of negative affect are at higher risk of using pornography as a mood enhancer (Qu et al., 2024). There could be two explanations for this inconsistency. First, while distress tolerance may indeed be relevant in understanding psychological processes related to pornography use, it may not necessarily be directly associated with PPU. Instead, distress tolerance could be linked to another variable explored in the literature (e.g., moral incongruence; Bőthe et al., 2024). As such, distress tolerance may be indirectly related to PPU.

Second, the concept of distress tolerance discussed in our study may be narrowly defined. Specifically, our study defines distress tolerance as the psychological ability to withstand negative emotional states (Simons & Gaher, 2005). However, it may only partially encompass the spectrum of distress experienced by individuals with higher severity in PPU. This is because the distress experienced by problematic pornography users may not be limited to emotional discomfort alone; it could also include sexual frustration (e.g., a state of dissatisfaction with sexual life; Lankford, 2021). This is supported by previous research, which has shown that biological determinants (e.g., hormonal factors) could contribute to PPU and that they represent related yet distinct dimensions (Dalooyi et al., 2023; Lankford, 2021). Therefore, our non-significant findings for

H3 may stem from the added nuance of sexual frustration in relation to PPU, which may not have been adequately considered in our measure of distress tolerance (i.e., DTS).

Limitations

There is one limitation noted in the current study. The conceptualization of psychological distress tolerance as a risk factor of PPU in the current study may not have fully encompassed the experience of distress tolerated by problematic pornography users (e.g., sexual frustration when resisting the temptation to view pornography). Thus, future studies could address this limitation by adapting Simons and Gaher's (2005) DTS scale, including a measure of sexual frustration. This would address the limitation by providing a more accurate measure of distress tolerance in the context of PPU while facilitating a clear differentiation between the contributions of sexual and emotional distress.

Implications

There are theoretical and clinical implications for this study. First, given distress tolerance is a stable trait (Leyro et al., 2010), it is recommended to be included in the I-PACE model as a risk factor for specific Internet-use disorders under personality, with a disclaimer that its influence can vary according to the specific online activity. Second, it could be beneficial to integrate emotional regulation interventions into treatment plans for individuals with high severity in IGD, PSMU, and PPU. Furthermore, combining emotional regulation interventions with strategies to enhance distress tolerance might be particularly beneficial for individuals with high severity in IGD (El-Ashry et al., 2023). However, it is important to note that future research should establish a causal role between these risk factors (i.e., emotional regulation and distress tolerance) and IGD, PSMU, and PPU before recommending these interventions in clinical practice.

Future Studies

As there is a saturation of cross-sectional studies examining specific Internet-use disorders and distress tolerance, longitudinal studies are recommended to establish a more robust understanding of cause-and-effect relationships (Yang et al., 2022). Additionally, future studies could explore potential moderators (e.g., psychological resilience as a moderator for distress tolerance and PSMU) to provide a more complete understanding of how distress tolerance might interact with other factors to influence the different types of specific Internet-use disorders.

Conclusion

To conclude, previous studies have focused on distress tolerance predicting non-technological addictions and general Internet use. Thus, this was the first study to examine distress tolerance as a risk factor for IGD, PSMU, and PPU. Our results align with the I-PACE model that some specific Internet-use disorders exhibit unique characteristics (Brand et al., 2016). The current research has three main findings. First, the effects of distress tolerance could be emphasized in existing IGD models to provide a more complete understanding of the development and maintenance of the disorder. Second, distress tolerance is proposed to be included in the I-PACE framework as a risk factor for specific Internet-use disorders with varying influence across different Internet activities. Lastly, emotional regulation interventions may be beneficial for individuals with high severity in IGD, PSMU, and PPU. Altogether, the current study has extended on the distress tolerance literature and provided valuable insights into specific Internet-use disorders.

Author Contribution Yuan Chong Hew: conceptualization; methodology; formal analysis; writing—original draft; writing—review and editing.

Peter K. H. Chew: conceptualization; methodology; writing—review and editing; supervision.

Funding Open Access funding enabled and organized by CAUL and its Member Institutions.

Data Availability The data is available upon request.

Code Availability N/A.

Declarations

Ethics Approval The study was approved by James Cook University's Human Research Ethics Committee (approval number: H9345).

Consent to Participate Participants provided their informed consent to participate in the study.

Consent for Publication Participants provided their informed consent to publish the study.

Competing Interests The authors declare no competing interests.

Open Access This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will

need to obtain permission directly from the copyright holder. To view a copy of this licence, visit http://creativecommons.org/licenses/by/4.0/.

References

American Psychiatric Association. (2022). Substance-related and addictive disorders. In *Diagnostic and statistical manual of mental disorders* (5th ed., text rev.). https://doi.org/10.1176/appi.books.9780890425787.x16_Substance_Related_Disorders

Andreassen, C. S., Billieux, J., Griffiths, M. D., Kuss, D. J., Demetrovics, Z., Mazzoni, E., & Pallesen, S. (2016). The relationship between addictive use of social media and video games and symptoms of psychiatric disorders: A large-scale cross-sectional study. *Psychology of Addictive Behaviors, 30*(2), 252–262. https://doi.org/10.1037/adb0000160

Babiker, A., Almourad, M. B., Panourgia, C., Alshakhsi, S., Montag, C., & Ali, R. (2023). Need for affect, problematic social media use and the mediating role of fear of missing out in European and Arab samples. *Psychology Research and Behavior Management, 16*, 5025–5039. https://doi.org/10.2147/prbm.s435437

Blasi, M. D., Giardina, A., Giordano, C., Coco, L. C., Tosto, C., Billieux, J., & Schimmenti, A. (2019). Problematic video game use as an emotional coping strategy: Evidence from a sample of MMORPG gamers. *Journal of Behavioral Addictions, 8*(1), 25–34. https://doi.org/10.1556/2006.8.2019.02

Bőthe, B., Tóth-Király, I., Zsila, Á., Griffiths, M. D., Demetrovics, Z., & Orosz, G. (2018). The development of the Problematic Pornography Consumption Scale (PPCS). *The Journal of Sex Research, 55*(3), 395–406. https://doi.org/10.1080/00224499.2017.1291798

Bőthe, B., Vaillancourt-Morel, M. P., Bergeron, S., Hermann, Z., Ivaskevics, K., Kraus, S. W., Grubbs, J. B., (2024). Uncovering the most robust predictors of problematic pornography use: A large-scale machine learning study across 16 countries. *Journal of Psychopathology and Clinical Science*https://doi.org/10.1037/abn0000913

Brand, M. (2022). Can Internet use become addictive? *Science, 376*(6595), 798–799. https://doi.org/10.1126/science.abn4189

Brand, M., Young, K., Laier, C., Wölfling, K., & Potenza, M. N. (2016). Integrating psychological and neurobiological considerations regarding the development and maintenance of specific Internet-use disorders: An interaction of person-affect-cognition-execution (I-PACE) model. *Neuroscience & Biobehavioral Reviews, 71*, 252–266. https://doi.org/10.1016/j.neubiorev.2016.08.033

Brandtner, A., Antons, S., Cornil, A., & Brand, M. (2021). Integrating desire thinking into the I-PACE model: A special focus on Internet-use disorders. *Current Addiction Reports, 8*(4), 459–468. https://doi.org/10.1007/s40429-021-00400-9

Dalooyi, S. I. S., Sharbaaf, H. A., Abdekhodaei, M. S., & Chamanabad, A. G. (2023). Biopsychosocial determinants of problematic pornography use: A systematic review. *Addiction and Health*, 15(3), 202–218. https://doi.org/10.34172/ahj.2023.1395

Dong, Y., & Peng, C. J. (2013). Principled missing data methods for researchers. *SpringerPlus*, 2(1). https://doi.org/10.1186/2193-1801-2-222

El-Ashry, A., Atta, M. H. R., Alsenany, S., Abdelaliem, S. M. F., & Khedr, M. A. (2023). The effect of distress tolerance training on problematic Internet use and psychological wellbeing among faculty nursing students: A randomized control trial. *Psychology Research and Behavior Management, 16*, 4015–4032. https://doi.org/10.2147/prbm.s423194

Giardina, A., Schimmenti, A., Starcevic, V., King, D. L., Blasi, M. D., & Billieux, J. (2024). Problematic gaming, social withdrawal, and escapism: The compensatory-dissociative online gaming (C-DOG) model. *Computers in Human Behavior*, 155, Article 108187. https://doi.org/10.1016/j.chb.2024.108187

Girotti, M., Adler, S. M., Bulin, S. E., Fucich, E. A., Paredes, D., & Morilak, D. A. (2018). Prefrontal cortex executive processes affected by stress in health and disease. *Progress in Neuro-psychopharmacology & Biological Psychiatry, 85*, 161–179. https://doi.org/10.1016/j.pnpbp.2017.07.004

Gratz, K. L., & Roemer, L. (2004). Multidimensional assessment of emotion regulation and dysregulation: Development, factor structure, and initial validation of the Difficulties in Emotion Regulation Scale. *Journal of Psychopathology and Behavioral Assessment, 26*(1), 41–54. https://doi.org/10.1023/b:joba.0000007455.08539.94

Green, S. B. (1991). How many subjects does it take to do a regression analysis. *Multivariate Behavioral Research, 26*(3), 499–510. https://doi.org/10.1207/s15327906mbr2603_7

Griffiths, M. D., Kuss, D. J., & Demetrovics, Z. (2014). Social networking addiction: An overview of preliminary findings. In K. P. Rosenberg & L. C. Feder (Eds.), *Behavioral addictions* (pp. 119–141). *Elsevier*. https://doi.org/10.1016/b978-0-12-407724-9.00006-9

Gu, M. (2022). Understanding the relationship between distress intolerance and problematic Internet use: The mediating role of coping motives and the moderating role of need frustration. *Journal of Adolescence, 94*(4), 497–512. https://doi.org/10.1002/jad.12032

Hsu, T., Thomas, E. B., Welch, E. K., O'Hara, M. W., & McCabe, J. E. (2023). Examining the structure of distress tolerance: Are behavioral and self-report indicators assessing the same construct? *Journal of Contextual Behavioral Science, 27*, 143–151. https://doi.org/10.1016/j.jcbs.2023.02.001

Jeffries, E. R., McLeish, A. C., Kraemer, K. M., Avallone, K. M., & Fleming, J. B. (2015). The role of distress tolerance in the use of specific emotion regulation strategies. *Behavior Modification, 40*(3), 439–451. https://doi.org/10.1177/0145445515619596

Lankford, A. (2021). A sexual frustration theory of aggression, violence, and crime. *Journal of Criminal Justice*, 77. https://doi.org/10.1016/j.jcrimjus.2021.101865

Leyro, T. M., Zvolensky, M. J., & Bernstein, A. (2010). Distress tolerance and psychopathological symptoms and disorders: A review of the empirical literature among adults. *Psychological Bulletin, 136*(4), 576–600. https://doi.org/10.1037/a0019712

Li, S., Wu, Z., Zhang, Y., Xu, M., Wang, X., & Ma, X. (2023). Internet gaming disorder and aggression: A meta-analysis of teenagers and young adults. *Frontiers in Public Health, 11*. https://doi.org/10.3389/fpubh.2023.1111889

Linehan, M. M. (1993). *Skills training manual for treating borderline personality disorder*. The Guilford Press.

Little, R. J. A. (1988). A test of missing completely at random for multivariate data with missing values. *Journal of the American Statistical Association, 83*(404), 1198–1202. https://doi.org/10.2307/2290157

Naragon-Gainey, K., McMahon, T. P., & Chacko, T. P. (2017). The structure of common emotion regulation strategies: A meta-analytic examination. *Psychological Bulletin, 143*(4), 384–427. https://doi.org/10.1037/bul0000093

Pontes, H. M., & Griffiths, M. D. (2015). Measuring DSM-5 Internet gaming disorder: Development and validation of a short psychometric scale. *Computers in Human Behavior, 45*, 137–143. https://doi.org/10.1016/j.chb.2014.12.006

Pontes, H. M., Szabó, A., & Griffiths, M. D. (2015). The impact of Internet-based specific activities on the perceptions of Internet addiction, quality of life, and excessive usage: A cross-sectional study. *Addictive Behaviors Reports, 1*, 19–25. https://doi.org/10.1016/j.abrep.2015.03.002

Qu, S., Li, R., & Wang, J. (2024). Increased sensitivity for negative emotional images in individuals with problematic pornography

use. *Frontiers in Psychology*, 15. https://doi.org/10.3389/fpsyg.2024.1287455

Sánchez-Fernández, M., & Borda-Más, M. (2022). Problematic smartphone use and specific problematic internet uses among university students and associated predictive factors: A systematic review. *Education and Information Technologies, 28*(6), 7111–7204. https://doi.org/10.1007/s10639-022-11437-2

Schivinski, B., Brzozowska-Woś, M., Stansbury, E., Satel, J., Montag, C., & Pontes, H. M. (2020). Exploring the role of social media use motives, psychological well-being, self-esteem, and affect in problematic social media use. *Frontiers in Psychology*, 11. https://doi.org/10.3389/fpsyg.2020.617140

Simons, J. S., & Gaher, R. M. (2005). The Distress Tolerance Scale: Development and validation of a self-report measure. *Motivation and Emotion, 29*(2), 83–102. https://doi.org/10.1007/s11031-005-7955-3

Skues, J., Williams, B., Oldmeadow, J. A., & Wise, L. (2015). The effects of boredom, loneliness, and distress tolerance on problem Internet use among university students. *International Journal of Mental Health and Addiction, 14*(2), 167–180. https://doi.org/10.1007/s11469-015-9568-8

Stevens, M. W. R., Dorstyn, D., Delfabbro, P., & King, D. L. (2020). Global prevalence of gaming disorder: A systematic review and meta-analysis. *Australian and New Zealand Journal of Psychiatry, 55*(6), 553–568. https://doi.org/10.1177/0004867420962851

Wang, Y., Liu, M., & Nogueira, O. C. B. L. (2023). Prevalence and risk factors of internet gaming disorder under the COVID-19 pandemic among university students in Macao. *SAGE Open Nursing*, *9*. https://doi.org/10.1177/23779608231158158

Yang, H., Wang, Z., Elhai, J. D., & Montag, C. (2022). The relationship between adolescent emotion dysregulation and problematic technology use: Systematic review of the empirical literature. *Journal of Behavioral Addictions, 11*(2), 290–304. https://doi.org/10.1556/2006.2022.00038

Yao, N., Chen, J., Huang, S., Montag, C., & Elhai, J. D. (2023). Depression and social anxiety in relation to problematic TikTok use severity: The mediating role of boredom proneness and distress intolerance. *Computers in Human Behavior*, *145*, Article 107751. https://doi.org/10.1016/j.chb.2023.107751

Young, K. S., & Brand, M. (2017). Merging theoretical models and therapy approaches in the context of Internet gaming disorder: A personal perspective. *Frontiers in Psychology*, 8. https://doi.org/10.3389/fpsyg.2017.01853

Zaorska, J., Rydzewska, M., Kopera, M., Wiśniewski, P., Trucco, E. M., Kobyliński, P., & Jakubczyk, A. (2023). Distress tolerance and emotional regulation in individuals with alcohol use disorder. *Frontiers in Psychiatry, 14*. https://doi.org/10.3389/fpsyt.2023.1175664

Zarate, D., Hobson, B. A., March, E., Griffiths, M. D., & Stavropoulos, V. (2023). Psychometric properties of the Bergen Social Media Addiction Scale: An analysis using item response theory. *Addictive Behaviors Reports*, 17, Article 100473. https://doi.org/10.1016/j.abrep.2022.100473

Zvolensky, M. J., Vujanovic, A. A., Bernstein, A., & Leyro, T. M. (2010). Distress tolerance. *Current Directions in Psychological Science, 19*(6), 406–410. https://doi.org/10.1177/0963721410388642

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.