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Need fulfilment and internet gaming disorder: A preliminary integrative model



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ABSTRACT

Background: The need for a better understanding of the risk factors underpinning disordered gaming has been consistently emphasized. Although, gaming may offer a simple and straightforward means of alleviating distress, relying on gaming to address one's unmet psychological needs could invite problematic usage. Self-determination theory highlights the significance of three universally inherent psychological needs for relatedness, competency, and autonomy. A motivation to engage in gaming may be to address unmet needs and may become problematic.

Objective: This study aimed to assess whether experienced levels of loneliness, depression and self-esteem mediate the association between Internet Gaming Disorder (IGD) behaviours and Need-Fulfilment deficits.

Method: The participants comprised of 149 adults (83 males, 66 females), aged between 18 and 62 years. A series of self-reported questionnaires assessing their levels of IGD behaviours, depression, loneliness, self-esteem and need-fulfilment were completed.

Results: Need-fulfilment deficits were linked to higher IGD behaviours. Interestingly, this association was mediated by the reported levels of self-esteem and depression and not loneliness.

Conclusions: The findings lend further empirical support for the mediating role of psychological distress between need fulfilment deficits and IGD behaviours.

1. Introduction

Internet Gaming Disorder (IGD) was incorporated within the appendix of the latest edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) as a condition requiring further investigation (American Psychiatric Association [APA], 2013). Although IGD as a construct remains contentious, its addition has marked a shift in the conceptualisation of disordered gaming and constitutes the most accepted and relevant term (Griffiths, King, & Demetrovics, 2014). Alternatives include gaming dependency (Dowling & Quirk, 2009) and gaming addiction (Lee & Han, 2007). Despite the inconsistencies in terminology, gaming involvement, at the expense of psychological and physical wellbeing has been consistently impacting some individuals, pursuing gaming either online or offline (Király, Nagygyörgy, Griffiths, & Demetrovics, 2014). Subsequently, the World Health Organization (WHO) recently recognised problematic gaming as a mental disorder, under the term 'Gaming Disorder', independent of the use of the Internet, within their recent revision of the International Classification of Diseases (WHO, 2018). Nevertheless, as the present work emphasizes on Internet gaming, the IGD definition will be employed here (APA,

2013).

1.1. Motivational factors that underpin IGD

Researchers in the field have repeatedly illustrated that understanding what underpins IGD is imperative considering its psychopathological classification and treatment (Petry & O'Brien, 2013; Pontes, Stavropoulos, & Griffiths, 2017; Stavropoulos, Kuss, Griffiths, Wilson, & Motti-Stefanidi, 2017). Interestingly, it has been postulated that the interplay among factors related to the gamer, the gamer's real context and the game platform it-self, varies the intensity of IGD behaviours exhibited (Burleigh, Stavropoulos, Liew, Adams, & Griffiths, 2018; Liew, Stavropoulos, Adams, Burleigh, & Griffiths, 2018). Indicatively, considering the gamer, anxiety and depression have been described as increasing IGD risk, while higher physical activity has been implied to reduce it (Adams et al., 2018; Burleigh et al., 2018; Liew et al., 2018). Regarding the gamer's context, among others, less cohesive families and more collectivistic cultures have been supported as IGD risk and protective factors respectively (Adams et al., 2018; Stavropoulos et al., 2018). Last, considering the game-platform, a

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higher sense of presence (i.e. experiencing the virtual world as real; Stavropoulos, Burleigh, Beard, Gomez, & Griffiths, 2018), a higher sense of immersion (i.e. experiencing the game related needs as real; Billieux et al., 2011; Kneer & Rieger, 2015) and a stronger bond with the avatar (i.e. figure of in game representation; Burleigh et al., 2018; Liew et al., 2018) have been envisaged as some of the most significant IGD risks. Overall, the interactions between the gamer, his/her real-life context and the game context have been viewed as definitive of both “distress reducing”, such as escapism, and “pleasure inducing”, such as gaming advancement and online socialization, playing motivations (Burleigh et al., 2018; Chang, Hsieh, & Lin, 2018; Liew et al., 2018; Nagygyörgy, Mihalik, & Demetrovics, 2012; Zanetta Dauriat et al., 2011). Provided that motivational factors have been implicated with the intensity of gaming involvement and thus, the development of IGD, they have attracted significant attention, with several theoretical conceptualizations aiming to demystify them (Adams et al., 2018; Ballabio et al., 2017; Burleigh et al., 2018; Griffiths et al., 2014; Liew et al., 2018; Rho et al., 2016).

1.2. Models of understanding IGD

In the broader context of motivational theories related to IGD, the Cognitive-Behavioural Theory of Pathological Internet Use (Davis, 2001) offers the advantage of providing a common basis for explaining both general and specific forms of pathological internet use, such as IGD. Within this theoretical context, for IGD to occur, maladaptive beliefs and behaviours that reinforce and maintain the dysfunctional response are required. Additionally, “distal factors” such as an underlying psychological issue (e.g., depression) and “proximal factors” such as problematic self-beliefs (such as belief characteristics of low self-esteem) and loneliness are also thought to be involved. These align with findings indicating that: a) depression along with maladaptive cognitions and shyness linked with IGD risk (Peng & Liu, 2010) and; b) lower levels of self-esteem associate with problematic gaming in general, as well as higher engagement into playing Massively Multiplayer Online Role Playing Games in particular (MMORPGs; Ko et al., 2005; Stetina, Kothgassner, Lehenbauer, & Kryspin-Exner, 2011).

A newer model that expands on the aforementioned theory is a process model titled the Interaction of Person-Affect-Cognition-Execution (I-PACE). I-PACE was developed to help explain the origin of specific forms of Internet addiction through the integration of biopsychological factors (Brand, Young, Laier, Wöfling, & Potenza, 2016). In brevity, according to this model, addiction to specific internet functions stems from an interaction between an individual's core characteristics such as genetics, predisposing factors such as early childhood experiences, as well as several mediators and moderators, such as copings styles and cognitive related biases.

Other theoreticians adopted an alternative “typological” approach in understanding IGD manifestation patterns (Rho et al., 2016). Specifically, they proposed that IGD typologies/patterns are informed by six indicators, average weekday gaming time, gaming community meeting attendance, leisure gaming time, marital status and Internet game addiction perceptions. Accordingly, three IGD patterns were suggested: a) the cost-consuming; b) the socializing and; c) the solitary type, primarily described by game related spending, game related socialization and lack of game related socialization and romantic partnership in real-life, respectively (Rho et al., 2016).

1.3. The potential role of self-determination

Interestingly, one could suggest that a common theoretical denominator of the aforementioned IGD models is the need for fulfilment and the meaning obtained through gaming (Burleigh et al., 2018). Such a need could be addressed in the context of a sense of belonging, a sense of purpose and a sense of achievement experienced online (Liew et al., 2018; Smith, 2017). Therefore, understanding the development of IGD

in the context of Self-Determination Theory (SDT) could offer insight into this inquiry. According to SDT, self-determination is the mechanism that encourages people to engage in actions that are of interest to them to help fulfil their own potential (Deci & Ryan, 1985). SDT, posits that individuals universally aim to fulfil the three inherent psychological needs of relatedness, competency, and autonomy (Deci & Ryan, 2011). According to SDT, the degree of motivation to engage in any activity depends on the degree to which fulfilment of the three basic psychological needs is possible. Gaming may offer an accessible and immediate means for attempting to satisfy deficits in relatedness, autonomy and competence. Thus, if individuals are failing to have their needs satisfied in real-life, they may be driven online to achieve an overall sense of validation. This could decrease the distress and self-esteem related issues (distal and proximal factors; Davis, 2001), which they might have experienced due to their needs not being met in real life (Anderson, Steen, & Stavropoulos, 2017). At this point it should be noted that Ryan, Lynch, Vansteenkiste, and Deci (2013) differentiated “need frustration” from “low need-fulfilment”, based on the external disruptive factors occurring on a daily basis. Not surprisingly, studies have demonstrated that higher frustration (Mills, Milyavskaya, Mettler, & Heath, 2018) and lower fulfilment (Weinstein, Przybylski, & Murayama, 2017) of basic psychological needs in daily life are risk factors to the development of IGD. These findings have prompted recommendations for further research focusing on the complicated interplay between IGD and SDT associated factors (Mills, Milyavskaya, Mettler, Heath, & Derevensky, 2018).

1.3.1. The present study

In response to these recommendations, this study seeks to combine the core constituents of SDT with the factors proposed by Davis (2001), as well as the I-PACE (Brand et al., 2016) to explain the development of IGD. Fig. 1 below portrays the proposed integrative model.

The following hypotheses are formulated:

- H1. Deficits in need-fulfilment will be positively associated with IGD behaviours.
- H2. Depression, loneliness and low self-esteem will mediate the relationship, if any, between deficits in need fulfilment and IGD.

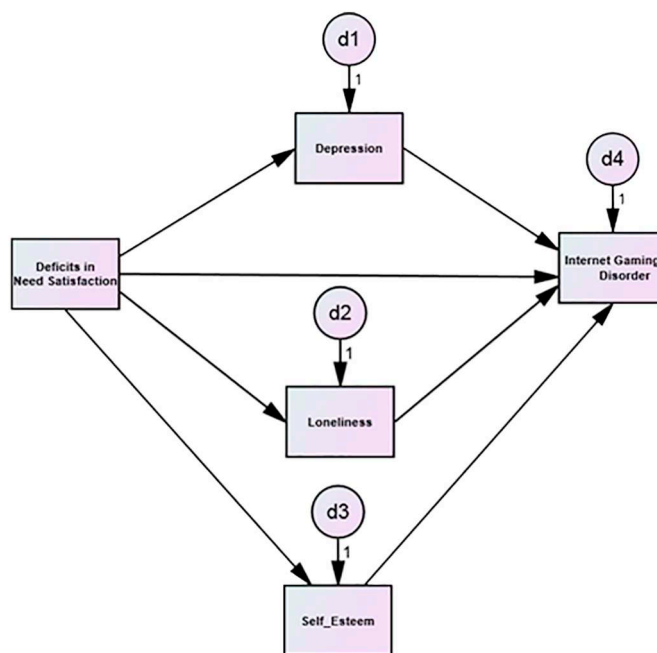


Fig. 1. Hypothesized integrative IGD model.

2. Method

2.1. Participants

A normative sample total of 149 adult gamers [83 (55.7%) males, 66 (44.3%) females] were recruited online (via Facebook-networking). Their age range in years was 18–62 ($M = 27.45$, $SD = 8.49$). No significant differences were found in terms of age between the genders $t_{(145)} = 0.83$, $p = .410$ according to an independents sample test. Online data collection was chosen, as it provides higher accessibility and representation of Internet Gamers (Griffiths, 2010).

2.2. Measures

International Consensus Items to Measure Internet Gaming Disorder (ICGD). The scale was devised by numerous authorities on IGD, such as the associates of the DSM-5 Substance Use Disorder Workgroup to assess IGD (Petry et al., 2014). It involves 9 items (e.g. *Do you feel restless, irritable, moody, angry, anxious, or sad when attempting to cut down or when you are unable to play?*) rated on a five-point Likert-scale (1 = *Never* to 5 = *Very Often*). Items' scores are accumulated resulting in a range of 9 to 45 with lower scores indicating lower symptoms. The internal consistency for the present study was satisfactory with a Cronbach's alpha of 0.88.

The Depression subscale of the Depression, Anxiety and Stress Scale (DASS-21; Lovibond & Lovibond, 1995), was utilised to dimensionally assess depression. The subscale includes 7 items with responses ranging from 0 (*Never*) to 3 (*Almost Always*). An example item includes "I couldn't seem to experience positive feelings at all." Items scores are added resulting to a range between 0 and 21, with higher totals revealing higher symptoms. Its internal consistency was excellent for the present study with a Cronbach's alpha of 0.91.

The Rosenberg Self-Esteem Scale (RSES; Rosenberg, 1965), was used to assess self-esteem. This scale is comprised of an equal number of positively and negatively worded items with responses varying from 0 (*Strongly Disagree*) to 3 (*Strongly Agree*), 10 in total. An example item includes "At times, I am no good at all." Final scores vary from 0 to 30, with a higher score being indicative of a higher level of self-esteem. Considering the present study, the scale's internal consistency was excellent with a Cronbach's alpha of 0.90.

The University of California, Los Angeles Loneliness Scale (UCLA) Loneliness Scale (3rd ED; Russell, 1996), was utilised to measure the perceived level of loneliness. This is comprised of 9 positively and 11 negatively worded items, with responses varying from 1 (*Never*) to 4 (*Always*). An example item includes "How often do you feel that there is no one you can turn to?" Item responses are accumulated to inform a final score ranging from 0 to 80, with higher scores indicating higher loneliness. In the present study the internal consistency of the scale was excellent with a Cronbach's alpha of 0.93.

The general version of the *basic psychological need-fulfilment scale (BPNS)* was used to measure the extent to which needs for autonomy, competence and relatedness are satisfied (Sheldon, Elliot, Kim, & Kasser, 2001). The scale is comprised of 18 positively and 9 negatively worded items, with scores rated on a Likert scale ranging from 1 (*Completely Disagree*) to 5 (*Completely Agree*). Examples items include "I feel like I am free to decide for myself how to live my life" and "I really like the people I interact with." Items' scores are accumulated resulting to a final score ranging between 27 and 135 with higher scores reflecting higher need satisfaction. The internal consistency for the present study was excellent with a Cronbach's alpha of 0.91. As need deficits were measured here, scores were deducted from the highest possible score.

2.3. Procedure

The study was approved by the ethics committee of the Cairnmillar Institute (Australia). Eligible individuals, adult online gamers, were

recruited online through social media. Participation was voluntary. Participants were directed to the questionnaire using the SurveyMonkey link. They were informed about the nature of the study by way of the Plain Language Information Statement. Participants were free to withdraw at any time without any consequences. Consent was deemed to be given upon completion.

2.4. Statistical analysis

The hypotheses were assessed by way of path analysis through AMOS 25. This permitted simultaneous testing of the hypothesized mediation effects and also easy modification of models according to parameter estimates and model fit statistics. Following Walker (2010), Chi Square (χ^2 , χ^2/df), CFI, TLI, SRMR, RMSEA together with the 90% CI and ECVI were used to assess model fit. Chi Square values with a significance less than 0.05 indicate an inadequate fit. However, this statistic is known to be biased upwards in larger samples. Consequently, the indications based on Chi Square were viewed with caution (χ^2/df values which are in the vicinity of 2 are indicative of good model fit) and were assessed in relation to the other above benchmarks. For CFI and TLI values in excess of 0.9 support good model fit. For SRMR and RMSEA values below 0.08 are also indicative of good model fit. All models were estimated using Maximum Likelihood Estimation (MLE; Hu & Bentler, 1999).

3. Results

3.1. Data preparation

Prior to the analyses, variables were assessed for univariate and multivariate normality. Following Walker (2010) cut off points for skewness and kurtosis in respect to univariate normality were |3| and |8|. The critical value of Mardia's Kurtosis statistic was used to assess multivariate normality. Critical values greater than 1.96 suggest a departure from multivariate normality. The skewness and kurtosis coefficients for each of the variables and the critical value of Mardia's statistic are presented below (see Table 1). The skewness and kurtosis did not exceed the adopted benchmarks. Therefore, the variables were deemed to exhibit only mild deviations from univariate normality. However, the Mardia's critical ratio was 2.82, suggesting a departure from multivariate normality. MLE, of parameters (the default in Analysis of Moments Structures, AMOS), is robust to mild deviations from multivariate normality. As such and as aforementioned, it was used for model estimation. Furthermore, bootstrapped bias corrected standard errors were estimated, revealing minimal standard error bias (maximum standard error detected was 0.3 for the Self-Esteem and IGD association).

3.2. Descriptive statistics

Descriptive statistics for the whole sample and by gender considering their levels of IGD, depression, self-esteem, deficits in need-fulfilment and loneliness are presented below (see Table 2). Overall, the sample's scores were indicative of mild levels of depression, moderate

Table 1
Assessment of normality for deficit in need-fulfilment (BPNS), self-esteem (RSES), loneliness (UCLA), depression (DASS-21) and IGD (ICGD).

	Skewness	c.r.	Kurtosis	c.r.
BPNS	0.43	2.15	-0.37	-0.93
RSES	-0.83	-4.16	0.07	0.16
UCLA	0.25	1.24	-0.57	-1.43
DASS-21	0.97	4.83	-0.01	-0.02
ICGD	0.85	4.23	0.23	0.566
Multivariate			3.87	2.82

Table 2
Descriptive statistics for BPNS, DASS-21, ICGD and RSES.

	All		Gender			
			Male		Female	
	M	SD	M	SD	M	SD
DASS-21	5.51	5.09	5.90	5.08	5.02	5.11
UCLA	45.48	11.69	46.25	11.28	44.51	12.20
ICGD	18.31	7.68	99.58	19.83	102.62	21.13
RSES	29.49	4.80	19.63	7.31	16.66	7.88
BPNS	46.07	20.40	47.42	19.83	44.38	21.13

Note. Male $n = 83$, Female $n = 66$, Total $n = 149$.; DASS-21 = Depression Subscale of the Depression Anxiety and Stress Scale 21 items; UCLA = The University of California, Los Angeles Loneliness Scale; ICGD = International Consensus Gaming Disorder Items; RSES = Rosenberg Self Esteem Scale; BPNS = Basic Psychological Need-Fulfillment Scale.

levels of loneliness and relatively high levels of self-esteem (Lovibond & Lovibond, 1995). Testing for significant differences in the mean scores of these variables across genders showed no statistically significant differences. Moreover, the IGD scores within the current sample were generally reflective of individuals demonstrating rather mild levels of IGD (Petry et al., 2014).

3.3. Hypotheses tests

H1 (Deficits in need-fulfilment will be positively associated with IGD behaviours) was tested using a simple regression in AMOS. Deficits in need-fulfilment were calculated by deducting each of the scores from the highest possible score. Results showed that need-fulfilment deficits positively predicted IGD, ($\beta = 0.43, p < .001$) accounting for 19% of the IGD variance. Since this was a simple regression with one independent variable the standardised β coefficient represents the total standardised effect of in need-fulfilment deficits on IGD, which is 0.43. Therefore, H1 was supported. Subsequently, the model shown in Fig. 2 (full-model) was estimated to test H2 (Depression, loneliness and low self-esteem will mediate the relationship, if any, between deficits in need fulfilment and IGD). Fig. 2 shows standardised parameter

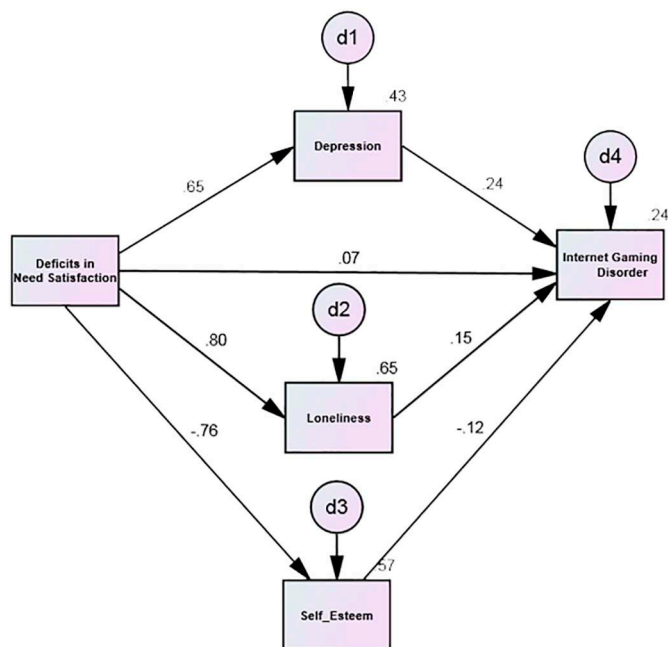


Fig. 2. Hypothesized integrative IGD model: standardised parameter estimates and R^2 coefficients.

Table 3
Pearson product-moment correlations for the relationships between BPNS, DASS-21, UCLA, RSES AND IGD.

	BPNS	DASS-21	UCLA	RSES	ICGD
BPNS	1				
DASS-21	0.66**	1			
UCLA	0.80**	0.60**	1		
RSES	-0.76**	-0.69**	-0.63**	1	
ICGD	0.43**	0.45**	0.42**	-0.43**	1

** $p < .001$.

Table 4
Parameter estimates for the fitted model (Full Model).

	B	SE B	β	C.R.	95% Confidence Interval (CI) for mean	
					Lower	Upper
BPNS to UCLA	0.46**	0.03	0.80	16.45	0.39	0.52
BPNS to RSES	-0.18**	0.01	-0.76	-14.03	-0.15	0.01
BPNS to DASS-21	0.16**	0.02	0.65	10.53	0.14	0.20
UCLA to ICGD	0.10	0.08	0.15	1.27	-0.01	0.26
DASS-21 to ICGD	0.35*	0.14	0.24	2.48	-0.01	0.65
RSES to ICGD	-0.20	0.17	-0.12	-1.10	-0.58	0.20
BPNS to ICGD	0.03	0.06	0.07	0.43	-0.09	0.11

Deficit in Need-fulfilment (BPNS), Self-Esteem (RSES), Loneliness (UCLA), Depression (DASS-21) and IGD (ICGD). 95% CI are based on bootstrapped estimates of standard errors.

** $p < .001$.

* $p < .05$.

estimates and R^2 coefficients (see above the figure rectangles). Results pertaining to H1 are presented below (see Table 3).

Table 4 shows that in the fitted model (full model); neither loneliness nor self-esteem were associated to IGD. Therefore, their mediative contribution in the relationship between need-satisfaction deficits and IGD was not supported. Mediation is only indicated when all links on an indirect path between a dependent variable and an independent variable are significant and the size of the coefficient on the direct path is reduced when the mediators are included in a model (Baron & Kenny, 1986). However, the mediating contribution of depression in the association between needs-satisfaction deficits and IGD was supported (all indirect paths were significant). Furthermore, the mediation was full since the direct path from needs-satisfaction deficits to IGD, was non-significant. Thus, H2 was partially supported.

3.4. Model fit indices

The full model fit statistics are shown below (see Table 5).

The fit statistics for the full model with the exception of CFI and SRMR were poor. In AMOS, modification indices are provided whereby indices with a coefficient of 4 or more indicate that model fit can be

Table 5
Model fit statistics for the full and revised model.

Model	χ^2	χ^2/df	CFI	TLI	SRMR	RMSEA	(90% CI)
Full	29.54**	9.85	0.94	0.79	0.06	0.24	(0.17, 0.33)
Revised	0.95	0.95	1.00	1.00	0.03	0.00	(0.00, 0.21)

Note: χ^2 = Chi-square, df = degrees of freedom, χ^2/df = ratio of χ^2 to df, CFI = Comparative Fit Index, TLI = Tucker-Lewis Index, SRMR = Standardised Root Mean Square Residual, RMSEA = Root Mean Square Error of Approximation with 90% Confidence Intervals, ECVI = Expected Cross Validation Index, df, Initial = 131, Revised = 121, ** $p < .001$, (a) ECVI for independence model = 3.00, (b) ECVI for independence model = 1.91.

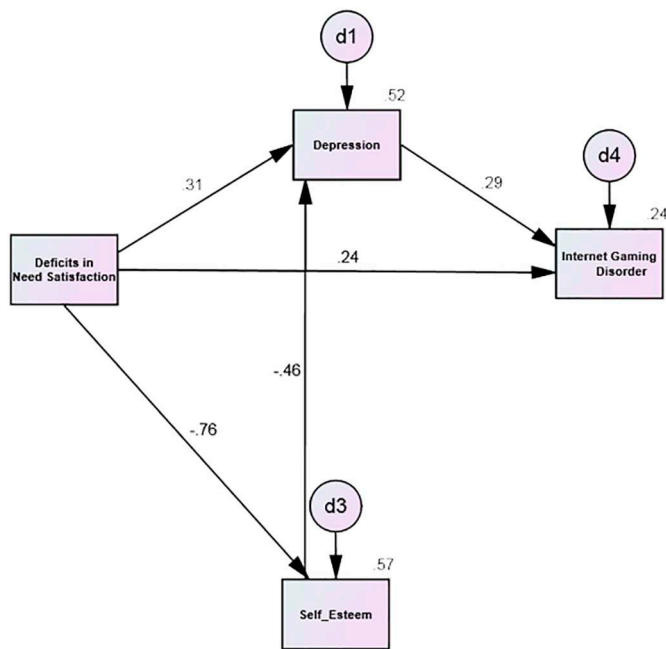


Fig. 3. Revised integrative IGD model: standardised parameter estimates and R² coefficients.

improved. For the full model the modification indices indicated that addition of two links, one between depression and self-esteem and one between Self-esteem and depression. However, since self-esteem was not predictive of IGD, a mediation path between needs-satisfaction deficits through depression and self-esteem to IGD could not be established. Since depression was associated to IGD and since needs-satisfaction deficit was associated to self-esteem a self-esteem-depression link was deemed plausible.

Provided that model fit can also be improved by eliminating redundant variables and insignificant links, loneliness was no longer included (see Fig. 3). The non-significant link between self-esteem and IGD was also removed. The revised model with standardised parameter estimates and R² is visualized in Fig. 3. Fit statistics for the revised model are also shown in Table 5. Based on the benchmarks for model fit, the revised model showed excellent model fit. Specifically, a serial mediation between need-satisfaction deficits and IGD through self-esteem and depression is indicated. This was not foreshadowed in the original hypothesis.

As may be seen below all paths in the revised model are statistically significant and the mediation is partial since the direct path from deficits in need-fulfilment to IGD, although reduced from 0.43 to 0.24 remained significant (see Table 6).

Table 6
Parameter estimates for the revised model.

	B	SE B	β	C.R.	95% Confidence Interval (CI) for mean	
					Lower	Upper
BPNS to RSES	-0.18**	0.01	-0.76	-14.03	-0.20	-0.15
BPNS to DASS-21	0.08**	0.02	0.31	3.54	0.02	0.12
RSES to DASS-21	-0.49**	0.09	-0.46	-5.26	-0.72	-0.30
DASS-21 to ICGD	0.46*	0.14	0.30	3.11	0.16	0.79
BPNS to ICGD	0.09*	0.04	0.24	2.54	-0.01	0.16

Note. *p < .05, **p < .001**, 95% CI are based on bootstrapped estimates of standard errors.

3.5. Mediation effect sizes

The degree of mediation in the revised model was assessed by partitioning the total standardised effect (0.43) of deficits in need-fulfilment on IGD into standardised direct and indirect effects. The total standardised direct effect was 0.24. The total standardised indirect effect was 0.19. As a proportion of the total standardised effect, this standardised indirect effect was 0.44. Thus, the mediation was not insubstantial. The total standardised indirect effect was partitioned as follows: deficits in need-satisfaction to self-esteem to depression to IGD = 0.10 (i.e., -0.76 * -0.46 * 0.29 = 0.10). As a proportion of the standardised indirect effect of 0.19 this is 0.53. The standardised indirect effect of deficits in need-satisfaction on IGD through depression was 0.09 (i.e., 0.31 * 0.29 = 0.09). As a proportion this is 0.47. Thus, the serial mediation effect through self-esteem and depression was proportionally larger than that from deficits in need-satisfaction to depression to IGD. As may be seen in the revised model the predictive capacity of deficits in need-satisfaction on depression (R² = 0.52) and self-esteem (R² = 0.57) were deemed valuable. The overall predictive capacity of deficits in need-satisfaction on IGD taking into account the mediators was R² = 0.24. Therefore, the proportion of variance explained approximates one fourth.

4. Discussion

This study examined a normative online sample of Internet gamers, to advance the understanding of IGD through the lenses of a preliminary, integrative, theoretical conceptualisation. In particular, it combined the core constituents of SDT, Davis' Pathological Internet Use model (2001) and I-PACE (Brand et al., 2016) into one hybrid model. This aimed to demystify the pathways by which deficits in need satisfaction could be associated with IGD behaviours. The findings provide evidence that gamers, who experienced deficits in need-fulfilment, may have lower self-esteem and are likely to become more depressed. As a consequence, IGD behaviours develop as a dysfunctional emotion regulation strategy. These can be significantly informative for more targeted and effective IGD prevention and intervention initiatives.

4.1. Deficits in need-fulfilment and IGD

Consistent with the studies by Senol-Durak and Durak (2011), as well as Ryan, Rigby, and Przybylski (2006), H1 was supported, revealing that deficits in need-fulfilment were significantly associated to higher IGD. In line with SDT, this finding suggests that individuals experiencing deficits in need-fulfilment may spend a considerable amount of time partaking in gaming. As stated earlier, according to SDT, the degree of motivation to engage in any activity is contingent on the degree to which the three basic psychological needs of relatedness, competence and autonomy are satisfied. Thus, based on the empirical findings reported here, individuals who are struggling to fulfil their basic psychological needs in real life may resort to gaming to address these deficits, given the alluring contingencies being offered by this appealing medium. This aligns with the compensatory internet use hypothesis (Kardefelt-Winther, 2014), and helps to address IGD more effectively. Specifically, SDT needs deficiencies acting as precipitating factors (e.g. when these needs are not met in real life) and perpetuating IGD factors (i.e. when these needs are met in the game) should be prioritized in IGD treatment. This line of inquiry could explain how the satisfaction of such needs in the game could strengthen IGD manifestations. Psycho-education and reframing strategies defining IGD as the problematic solution of pre-existing problems/needs deficits could in that line be significantly effective (Anderson et al., 2017), especially when combined with problem solving strategies addressing need-deficits in their real life context (Adams et al., 2018; Burleigh et al., 2018).

4.2. Serial mediation: self-esteem and depression

The finding that the association between need-fulfilment deficiencies and IGD could be explained through depression and lower self-esteem but not loneliness presents as important. It suggests that depression is likely the more definitive pathway for gamers with insufficiently satisfied self-determination needs to develop IGD, especially when combined with lower self-esteem. This aligns with a significant body of literature (Adams et al., 2018; Anderson et al., 2017; King & Delfabbro, 2014; Ko et al., 2005; Stetina et al., 2011). One could assume that the lack of need-satisfaction may trigger reactive depressive symptoms, which could latter induce IGD behaviours, as a maladaptive emotion-regulation and compensatory strategy (Adams et al., 2018; Anderson et al., 2017). In keeping with this, it is plausible that need-fulfilment deficits could reduce an individual's self-esteem, making him/her depressed, thus generating a need to escape in the more inviting and satisfying gaming world (where his/her self-esteem and mood could be balanced by in-game achievements, socialization and thus a sense of achievement (Adams et al., 2018; Liew et al., 2018)). Such an interpretation aligns with conceptualisations of addictions, as maladaptive mechanisms for addressing demanding human needs for positive feelings and satisfaction (Griffiths, 2005; Stavropoulos, Anderson, et al., 2018). Nevertheless, given evidence linking loneliness to IGD (e.g., Qin, Rao, & Zhong, 2007; Parsons, 2005; Lemmens, Valkenburg, & Peter, 2009; Kim, Larose, & Peng, 2009) the finding that loneliness does not associate with IGD behaviours in the context of need-satisfaction deficits requires cautious interpretation. It is likely that due to online socialization, the experience/nature (online vs offline) of loneliness reported here was affected. This agrees with literature suggesting that online relationships interfere and often moderate the sense of loneliness in real-life increasing internet absorbance (Anderson et al., 2017). Therefore, it is hypothesized that for a proportion of the present sample's IGD behaviours may have not co-existed with high experience of loneliness due to in game relationships (Adams et al., 2018). Overall though, the present finding is deemed of high value, as it indicates that the assessment and treatment of need-deficiencies should likely be prioritized over low-self-esteem and depressive presentations, in the context of IGD behaviours. This corroborates significant past evidence illustrating need-deficiencies as the common and primary denominator of various reactive/secondary presentations (Ryan, 2009). This could potentially optimise the distribution of treatment resources.

5. Conclusions, limitations and future directions

Conclusively, it seems reasonable to envisage, that deficits in need-satisfaction may lead individuals to experience lower levels of self-esteem and thus higher levels of depression, which could in turn result to addictions (such as IGD has been conceptualised; Anderson et al., 2017) as maladaptive emotion regulation behaviours. Specifically, unmet psychological needs may lead gamers, who experience psychological distress, to develop IGD behaviours, since they may game to compensate for unmet real-world needs.

However, given the cross-sectional nature of the data, causative associations could only be speculated here. It is also important to note that as the examined sample was generally reflective of sub-clinical levels of IGD, the findings may not be generalizable to clinical IGD populations. Finally, another potential limitation of this study is that it did not distinguish between different game genres.

Hence going forward, longitudinal studies of clinical IGD populations, taking into consideration how different game genres involve with gaming motivation would be recommended. These could inform about potential reciprocal relationships and advance the accuracy of IGD case formulations, which guide treatment plans, in the context of different game genres. Based on the present findings, it may be pertinent for clinicians to carefully examine their clients' environmental factors that

may be eliciting feelings of un-fulfilment and lack of meaning in their lives, as these could be giving rise to maladaptive coping responses such as IGD. Supporting clients to achieve a sense of fulfilment and purpose in the real-world may overtime result in a decline in the amount of IGD behaviours being exhibited.

Conflict of interest

The authors of the present study do not report any conflict of interest.

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