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FULL-LENGTH REPORT

Gaming disorder and compensation-based gaming motivations: A longitudinal study of emerging adults

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ABSTRACT

Background: Gaming motivations are central to understanding why individuals engage in video games and why some develop problematic patterns. However, while longitudinal studies are emerging, cross-sectional work still predominates, leaving dynamic processes underexplored. This study examined how gratification- and compensation-related gaming motivations predict the development of Gaming Disorder (GD) among emerging adults. *Methods:* We conducted a three-wave, pre-registered longitudinal survey with 438 emerging adults, each wave spaced three months apart. GD severity was measured with the IGDS9-SF, and motivations (Coping, Escape, Fantasy, Identity, Introjected Regulation) were assessed using the Gaming Motivation Inventory. Cross-lagged panel models (CLPM) and random-intercept CLPM (RI-CLPM) were employed to separate between-person stability from within-person dynamics. *Results:* Concurrent associations showed that all motivations correlated positively with GD severity at each wave. Longitudinally, compensation-related motivations (Coping and Escape) demonstrated delayed reciprocal effects with GD: earlier motivations predicted later GD, and GD subsequently reinforced these motivations. Introjected Regulation showed reciprocal effects in CLPM but not in RI-CLPM, suggesting that they reflected between-person differences rather than within-person change. Gratification-related motivations (Fantasy and Identity) did not predict GD over time. *Discussion:* Findings highlight the dynamic interplay between compensation motivations and GD, consistent with theories emphasizing a shift from gratification to compensation as disorder develops. However, gratification motivations appear to function primarily as common entry points into gaming rather than predictors of disorder. These results underscore the need for longitudinal investigations with sufficient temporal depth to capture how motivational changes interact with contextual and individual factors in the escalation of GD.

KEYWORDS

gaming disorder, gaming motivations, compensation, gratification, longitudinal study, I-PACE model

INTRODUCTION

Problematic gaming has increasingly been conceptualized within the broader framework of behavioral addictions. In formal diagnostic systems, Gaming Disorder has been included in the ICD-11 as a disorder due to addictive behaviors, whereas Internet Gaming Disorder has been recognized in the DSM-5 as a condition for further study (Brand et al., 2025a, b). In the present paper, we use the term Gaming Disorder (GD) as a general label for problematic gaming symptoms, although the construct is operationalized using the Internet Gaming

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Disorder Scale–Short Form (IGDS9-SF), which reflects DSM-5 IGD criteria. Although most individuals engage in gaming without adverse outcomes, a minority develop problematic patterns that may lead to significant impairment. Consequently, identifying psychological mechanisms and risk factors underlying problematic gaming has become a key research priority (Király, Koncz, Griffiths, & Demetrovics, 2023). Among these mechanisms, motivational processes are particularly important, as they capture the reasons why individuals initiate and maintain gaming behavior and may shape the transition from recreational engagement to maladaptive involvement. A substantial body of research indicates that the reasons why individuals play games are systematically associated with both healthy engagement and problematic gaming outcomes (Demetrovics et al., 2011; Yee, 2006; Bäcklund, Elbe, Gavelin, Sörman, & Ljungberg, 2022; Király et al., 2022).

Nevertheless, most prior studies on motivation have relied on cross-sectional designs. Although longitudinal investigations have grown considerably in recent years (eg. Qi, Li, & Zhu, 2025; Wang et al., 2022; Ye, Fong, & Yip, 2025; Zhou, Zhao, Wang, & Zhu, 2023), inference about temporal dynamics remains limited (Hamaker, Kuiper, & Grasman, 2015; Orth, Clark, Donnellan, & Robins, 2021). The primary objective of the current study was to examine the longitudinal associations between gaming motivations and GD among emerging adults. Early adulthood, a developmental stage marked by major life transitions, including educational, occupational, and social changes, may increase vulnerability to problematic gaming (Arnett, 2000; Schulenberg & Maggs, 2002). To address this objective, we applied cross-lagged panel models, including cross-sectional correlations between GD and motivations, autoregressive paths, and bidirectional cross-lagged effects (Hamaker et al., 2015; Orth et al., 2021).

We employed the comprehensive model of gaming motivation by Király and colleagues, which distinguishes six higher-order motivations: Mastery, Immersion/Escapism, Competition, Stimulation, Social and Habit/Boredom (Király et al., 2022). Among these, the Immersion/Escapism dimension is of particular interest, as it has been most consistently associated with GD (Bäcklund et al., 2022). This motivation captures the tendency to use gaming as a means of entering an alternative reality, coping with stress, or avoiding daily problems, processes that appear central in the development of problematic gaming and consists of the following factors: Coping, Escape, Fantasy, Identity, Introjected Regulation.

Importantly, although Király and colleagues did not explicitly propose such categorization, their motivational framework can be conceptually divided into motivations oriented toward achieving positive states (gratification-oriented motives) and those aimed at avoiding or regulating negative states (compensation-oriented motives). This distinction resonates with the Person–Affect–Cognition–Execution (I-PACE) model of addictive behaviors (Brand, Young, Laier, Wölfling, & Potenza, 2016; Brand et al., 2019, 2025a, b). According to the latest theoretical updates, it is critical to distinguish between usage motives (the pre-existing reasons for playing) and the actual subjective experiences of gratification and compensation that occur during the behavior (Wegmann, Knorr, Antons, & Brand, 2025).

While early versions of the I-PACE model suggested a linear shift from positive to negative reinforcement, current interpretations emphasize a more complex, “wave-like” development where both gratification and compensation processes coexist and fluctuate throughout the addiction process (Brand et al., 2025a, b). In this study, we focus on usage motives as predisposing factors that trigger these reinforcement cycles. Following this logic, Identity and Fantasy reflect gratification-oriented motivations (linked to positive reinforcement), whereas Escape, Coping, and Introjected Regulation represent compensation-oriented motivations (linked to negative reinforcement), as further specified in the recent systematic review by Wegmann et al. (2025).

While cross-sectional studies consistently demonstrate associations between both gratification and compensation motivations and GD (Bäcklund et al., 2022), the I-PACE framework emphasizes the interaction between individual predispositions, affective responses, and cognitive mechanisms in shaping addictive behaviors. It also highlights the temporal dynamics of these processes, making it particularly suitable for testing within a longitudinal design. Therefore, we hypothesized that gratification- and compensation-related motivations will play different roles in the developmental process of GD, which should be observable in a longitudinal framework.

Building on this, we assumed that gratification motivations might primarily precede GD, while compensation motivations would emerge mainly as consequences of GD. This distinction echoes addiction theories that differentiate between initial phase of addiction through positive reinforcement from its later maintenance through negative reinforcement (Robinson & Berridge, 2025; Wise & Koob, 2014). However, the reciprocal associations may be also plausible in such way that the compensation-related motivations might initially predict GD, but once GD develops it could in turn reinforce such motivations. The experience of disordered gaming can heighten stress, social withdrawal, or diminished coping resources, which in turn may strengthen reliance on Escape and Coping motivations (cf. Brand et al., 2019; Kardefelt-Winther, 2014), potentially leading to a compulsive “must-do” pathway of the behavior (Brand et al., 2025a, b). At the same time, in line with the I-PACE framework, it is important to recognize that such motivational processes interact with a range of other influences, including environmental and contextual factors, which may also shape outcomes over time.

Based on the above rationale, we formulated the following hypotheses focused on five motivational factors within the Immersion/Escapism dimension:

H1: Coping, Escape, Introjected Regulation, Fantasy, and Identity at T1, T2, and T3 will each correlate with the severity of GD at corresponding time points.

H2a: Time 1 motivational factors associated primarily with gratification (Fantasy, Identity) will positively predict the severity of GD at Time 2, controlling for GD severity at Time 1.

H2b: Time 2 motivational factors associated primarily with gratification (Fantasy, Identity) will positively predict the severity of GD at Time 3, controlling for GD severity at Time 2.

H3a: Time 1 severity of GD will positively predict the motivational factors associated primarily with compensation (Coping, Escape and Introjected Regulation) at Time 2, controlling for their prior level at Time 1.

H3b: Time 2 severity of GD will positively predict the motivational factors associated primarily with compensation (Coping, Escape and Introjected Regulation) at Time 3, controlling for their prior level at Time 2.

METHOD

Power analysis

An a priori power analysis was conducted using G*Power (Faul, Erdfelder, Buchner, & Lang, 2009). Prior research suggests that associations between GD and gaming motivations vary considerably (r = .07–.40; Wang & Cheng, 2022; r = .01–.68; Bäcklund et al., 2022). The development study of the Comprehensive Gaming Motivations Model reported comparable standardized coefficients for Immersion/Escapism ($\beta \approx .23$; Király et al., 2022). Based on these estimates, a sample size of $N = 470$ was deemed sufficient to detect small correlations of at least $r = .15$ (one-tailed, $p < .05$) with 95% power. Assuming attrition of 25% per wave (Teng et al., 2020), we planned to recruit approximately 855 participants at T1, anticipating 640 at T2 and 485 at T3. In practice, 780 participants were recruited at T1, 521 at T2, and 438 at T3. These numbers represent only participants whose data passed all quality checks, with attrition averaging about 22% per wave. Although below the initial recruitment target, this sample size was adequate for detecting the expected effect sizes.

Procedure and participants

The final sample comprised 438 participants (49.3% female, 47.0% male), aged 18–27 (M = 19.40, SD = 1.15) at T3. A small proportion identified outside the binary gender spectrum (1.6%) or chose not to disclose their gender (2.1%); See Supplementary materials for more detailed sample description.

The study consisted of three waves of data collection. Wave 1 (T1) was conducted in March–April 2024, Wave 2 (T2) in July–September 2024, and Wave 3 (T3) in October–December 2024. Each participant received a personalized invitation exactly three months after their previous assessment, ensuring consistent intervals within the data collection windows. If no response was received within one week, a single reminder email was sent. Participants' identities were verified in person during the administrative payment process to prevent fraudulent or duplicate participation.

Core measures relevant to the hypotheses were administered at the beginning of each wave. Additional exploratory questionnaires were included in later sections of the survey and varied across waves as part of the broader research project. These additional measures are not analyzed in the present manuscript, which is the first study based on this dataset and focuses exclusively on variables relevant to the hypotheses.

Participants received monetary compensation increasing across waves (PLN 20, 30, 40); administrative forms were kept separate from survey data to preserve anonymity.

Materials

The survey included measures that were either previously validated in Polish samples or adapted by the research team. Gaming Disorder (GD) severity was measured with the Internet Gaming Disorder Scale–Short Form (IGDS9-SF; Pontes & Griffiths, 2015; Schivinski, Brzozowska-Woś, Buchanan, Griffiths, & Pontes, 2018 for Polish validation), which assesses the nine DSM-5 criteria for GD on a five-point Likert scale. Coping, Escape, Fantasy, Identity, and Introjected Regulation motivations were assessed using subscales of the Gaming Motivation Inventory (GMI; Király et al., 2022; [masked]; the inventory has been administered in its full version). These five subscales load on the higher-order Immersion/Escapism dimension in the original validation of the GMI (Király et al., 2022). Demographic variables, including gender, age, nationality, and parents' education levels, were also collected.

Statistical analysis

The planned analyses focused on the longitudinal associations between gaming motivations and GD severity using both a conventional Cross-Lagged Panel Model (CLPM) and a Random Intercept Cross-Lagged Panel Model (RI-CLPM) (Hamaker et al., 2015; Orth et al., 2021). In the CLPM framework, autoregressive effects and cross-lagged paths were estimated across the three waves, assessing whether motivational factors measured at T1 predicted GD severity at T2 and, similarly, between T2 and T3. The RI-CLPM was additionally employed to partition stable, trait-like variance from within-person dynamic changes, thereby disentangling between-person differences from state-level fluctuations in the study variables. By comparing the two models, we aimed to determine whether accounting for random intercepts influenced the estimation and interpretation of cross-lagged effects. This dual approach provided a more comprehensive evaluation of longitudinal relationships between gratification- and compensation-related motivations and GD severity.

All statistical analyses were conducted in R (R Core Team, 2024) using the lavaan package (Rosseel, 2012). Maximum likelihood (ML) estimation with Yuan–Bentler correction was applied to account for potential non-normality. Models were estimated under the assumption of longitudinal measurement invariance across waves. Paths were freely estimated across adjacent intervals. There were no observations with missing data. Fit indices are reported in their robust versions (CFI, RMSEA, SRMR). Due to the fact that the χ^2 test is highly sensitive to large samples and RMSEA tends to be inflated in models with very few degrees of freedom (df = 4), both indices should be interpreted with caution (Kenny, Kaniskan, & McCoach, 2015).

Ethics

This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Research Ethics Committee at the Institute of Applied Psychology of the Jagiellonian University, with Opinion number 102/2021. All participants provided electronic informed consent before beginning each wave of the survey. Data confidentiality was strictly maintained throughout the study; identifying information used for compensation purposes was stored separately from survey responses to prevent any linkage between personal data and research findings. The study was pre-registered on the Open Science Framework (Strojny et al., 2024), ensuring transparency of hypotheses and analytic strategy. The pre-registration specified a broader set of motivational factors derived from the Gaming Motivation Inventory. For the purposes of the present manuscript, the analyses focus on five motivational factors belonging to the Immersion/Escapism dimension (Coping, Escape, Introjected Regulation, Fantasy, and Identity). The remaining pre-registered motivational factors are not analyzed in the present article.

RESULTS

First, we report concurrent correlations between gaming motivations and GD severity (H1). Next, we examine whether gratification-related motivations predicted subsequent GD severity (H2), followed by tests of whether GD severity predicted compensation-related motivations over time (H3). For each hypothesis, findings from both the conventional CLPM and the RI-CLPM are reported, allowing a comparison of effects across the two modeling approaches.

Concurrent correlations (H1)

Descriptive statistics and zero-order correlations among study variables at each wave are presented in the Supplement (Tables S1–S3). As hypothesized, GD severity was positively associated with all motivational factors at T1, T2, and T3. At T1 (Table S1), correlations ranged from small to moderate (r = .31–.55, $p < .01$), with the strongest association observed for Introjected Regulation. A similar pattern emerged at T2 (Table S2), where GD severity again showed positive associations with all motivations (r = .28–.56, $p < .01$). At T3 (Table S3), the correlations remained significant (r = .27–.60, $p < .01$), with the largest effect once more involving Introjected Regulation. Across all three waves, the consistent pattern of positive concurrent correlations supports H1, indicating that greater endorsement of both gratification- and compensation-related motivations co-occurred with higher levels of GD severity.

Gratification-related motivations predicting GD severity (H2)

Fantasy. In the CLPM including Fantasy, model fit was questionable (CFI = .92, RMSEA = .24), and cross-lagged paths from Fantasy to GD severity were small and non-significant (β = −.01–.02, ns). In contrast, the RI-CLPM showed excellent fit (CFI = 1.00, RMSEA = .00). At the between-person level, average Fantasy was positively associated with mean GD severity (r = .27, $p < .001$). At the within-person level, none of the cross-lagged effects were significant (see Supplementary Materials, Table S4). Overall, hypotheses H2a and H2b were rejected for Fantasy.

Identity

In the CLPM, model fit was questionable (CFI = .92, RMSEA = .25), and cross-lagged paths from Identity to GD severity were small and non-significant (β = .01, ns). The RI-CLPM showed excellent fit (CFI = 1.00, RMSEA = .00). At the between-person level, the random intercepts of Identity and GD severity were positively correlated (r = .26, $p < .001$). At the within-person level, all cross-lagged paths were non-significant.

Thus, hypotheses H2a and H2b were rejected for Identity (see Supplementary Materials, Table S5). This null finding stands in contrast to the significant H3a and H3b effects observed for Coping and Escape.

GD severity predicting compensation-related motivations (H3)

Coping. We first estimated a basic CLPM for GD severity and Coping. The scaled chi-square test ($\chi^2(4)$ = 50.61, $p < .001$) should be interpreted with caution. CFI = .94 suggested acceptable global fit, SRMR = .04 indicated excellent localized fit, whereas RMSEA = .19 (90% CI [.15, .23]) exceeded conventional cutoffs. Covariances between GD severity and Coping were positive and statistically significant at all time points. Regarding directional effects, Coping at T1 positively and significantly predicted GD severity at T2, whereas GD severity at T1 did not predict Coping at T2 (H3a rejected). In contrast, GD severity at T2 positively and significantly predicted Coping at T3 (H3b confirmed). Thus, CLPM suggested a delayed reciprocal pattern: earlier Coping increased later GD severity, while elevated GD severity at a subsequent time point increased later Coping (see Fig. 1).

The RI-CLPM model demonstrated very good fit, $\chi^2(1)$ = 2.55, p = .111, CFI > .99, RMSEA = .05 (90% CI [.00, .14]), and SRMR = .01, surpassing conventional thresholds. Random intercepts of GD severity and Coping

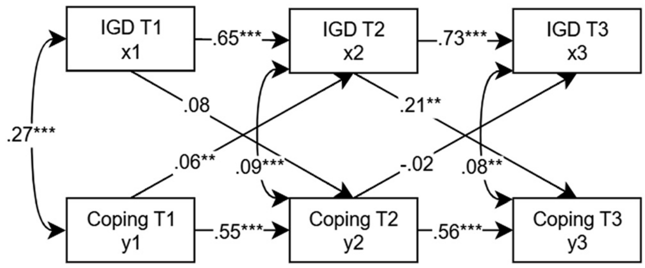

Fig. 1. CLPM model of GD severity and Coping with unstandardized regression and covariance coefficients

were positively and significantly correlated, indicating stable trait-like associations. Crucially, the same temporal structure as in the CLPM emerged. Coping at T1 predicted higher GD severity at T2, whereas GD severity at T1 did not predict Coping at T2. Again, GD severity at T2 positively and significantly predicted Coping at T3 (see Fig. 2). In both analytic approaches, the hypothesized effects were consistently observed, revealing a delayed bidirectional influence: Coping preceded later GD severity, and GD severity in turn predicted later Coping. This convergence across CLPM and RI-CLPM suggests that the interplay between maladaptive coping and GD severity unfolds not immediately, but with a lag across measurement waves.

Escape. In the next step we analyzed analogous models for GD severity and Escape. First, we estimated the CLPM. Significant chi-square test, $\chi^2(4) = 60.28$, $p < .001$, CFI = .94 suggested marginally acceptable global fit. RMSEA = .21 (90% CI [.17, .25]) exceeded conventional thresholds, although SRMR = .05 indicated good localized fit. Regarding cross-lagged effects, GD severity at T1 did not significantly predict Escape at T2, and GD severity at T2 did not predict Escape at T3. Escape at T1 showed a positive association with GD severity at T2 that approached significance ($p = .055$), suggesting a potential early influence, although this effect did not reach conventional thresholds. Thus, hypotheses H3a and H3b were rejected in the CLPM. Figure 3 presents the model with unstandardized coefficients.

The RI-CLPM showed excellent fit, $\chi^2(1) = 0.03$, $p = .862$, CFI = 1.00, RMSEA = .00 (90% CI [.00, .07]), SRMR = .002. Random intercepts of GD severity and Escape were positively and significantly associated, indicating stable trait-like covariation. Crucially, the same lagged reciprocal structure as in the GD severity–Coping models emerged: Escape at T1 significantly predicted GD severity at T2, whereas GD severity at T1 did not predict Escape at T2. In turn, GD severity at T2 significantly predicted Escape at T3 (see Fig. 4). In contrast to CLPM, in the RI-CLPM, H3a was rejected, but H3b was confirmed, consistent with a delayed reciprocal pattern observed in the case of Coping. In contrast to the CLPM, in the RI-CLPM H3a was rejected but H3b was confirmed, consistent with the delayed reciprocal pattern also observed for Coping.

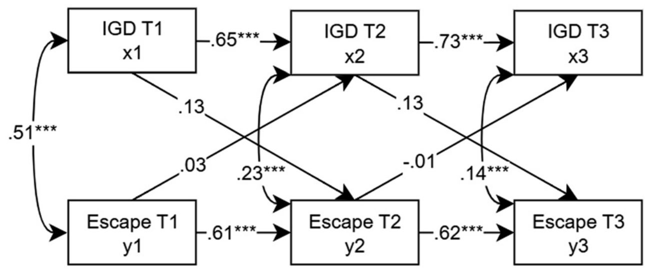

Fig. 3. CLPM model of GD severity and Escape with unstandardized regression and covariance coefficients

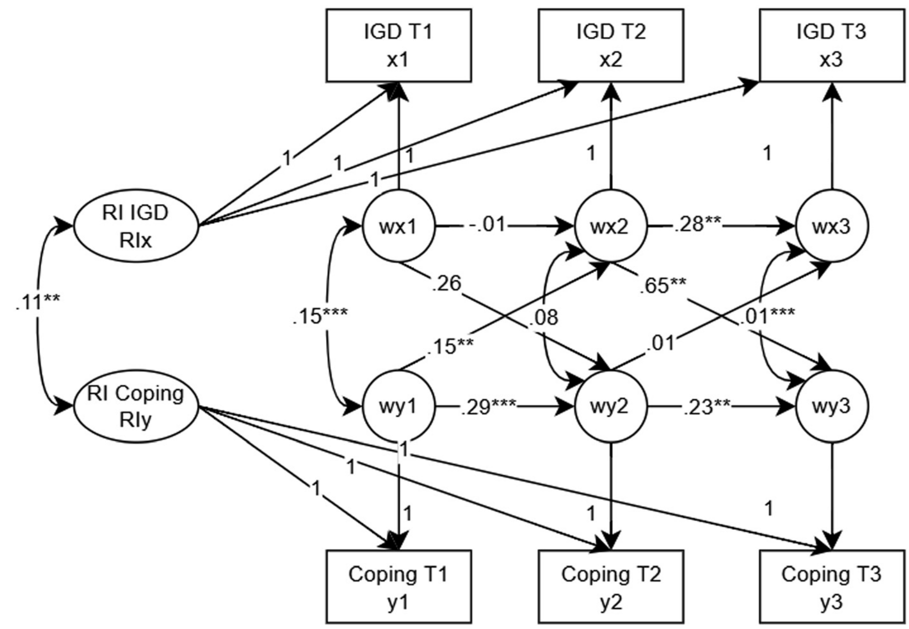

Fig. 2. RI-CLPM model of GD severity and Coping with unstandardized regression and covariance coefficients

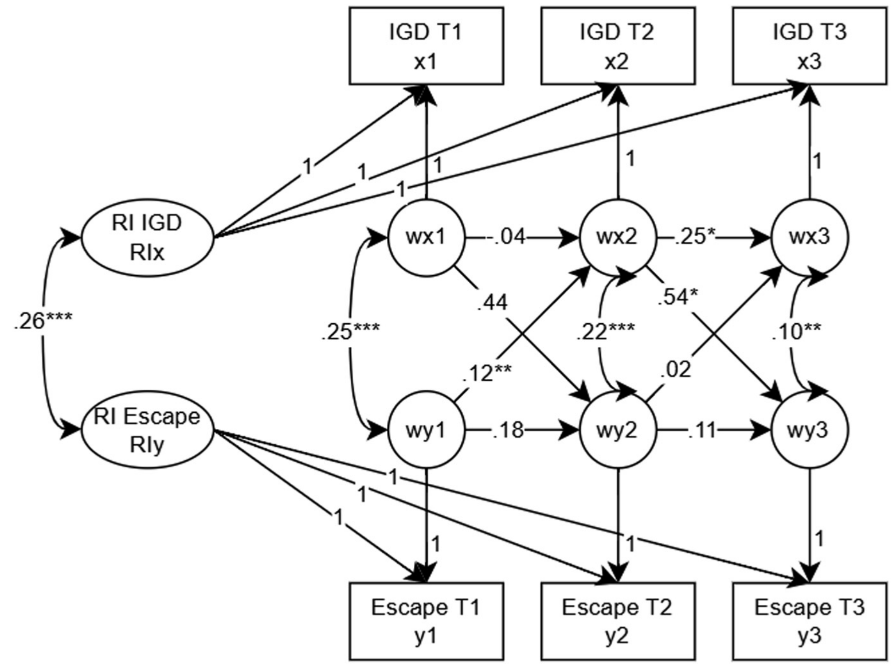

Fig. 4. RI-CLPM model of GD severity and Escape with unstandardized regression and covariance coefficients

Introjected regulation. We first estimated a basic CLPM for GD severity and introjected regulation. The scaled chi-square test indicated significant model–data discrepancy, $\chi^2(4) = 37.58$, $p < .001$. CFI = .96 suggested good overall fit, SRMR = .05 indicated acceptable localized fit, whereas RMSEA = .17 (90% CI [.13, .21]) exceeded conventional cutoffs. Covariances between GD severity and introjected regulation were positive and statistically significant at all time points. Regarding directional effects, introjected regulation at T1 significantly predicted GD severity at T2, and introjected regulation at T2 significantly predicted GD severity at T3. In the opposite direction, GD severity at T1 significantly predicted introjected regulation at T2, and GD severity at T2 predicted introjected regulation at T3. Thus, the CLPM suggested a mutually reinforcing dynamic: both constructs significantly predicted each other across adjacent waves, pointing to a reciprocal process of escalation over time (see Fig. 5).

The RI-CLPM model demonstrated excellent fit, $\chi^2(1) = 0.30$, $p = .582$, CFI > .99, RMSEA = .00 (90% CI [.00, .11]), and SRMR = .01, surpassing conventional thresholds. Random intercepts of GD severity and introjected regulation were positively and strongly correlated, indicating stable trait-like associations. Crucially, none of the cross-lagged paths between introjected regulation and GD severity reached significance, suggesting that the reciprocal pattern observed in the CLPM may reflect between-person differences rather than within-person temporal processes (see Fig. 5). Instead, significant residual covariances at adjacent time points indicated that short-term fluctuations in GD severity and introjected regulation tended to co-occur within individuals, but did not reliably predict each other over time. Together, these results suggest that introjected regulation and GD are closely linked at the between-person level, but the apparent reciprocal dynamics observed in CLPM may not represent genuine temporal influence within individuals. Notably, unlike the reciprocal patterns involving Coping and Escape, these effects did not remain significant once between-person variance was accounted for.

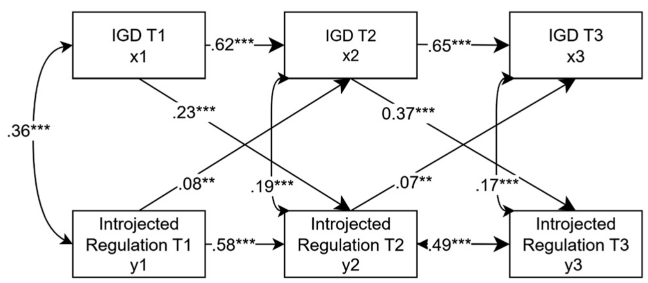

Fig. 5. CLPM model of GD severity and Introjected Regulation with unstandardized regression and covariance coefficients

DISCUSSION

The present longitudinal study investigated the role of gratification- and compensation-related gaming motivations in the development of Gaming Disorder (GD) among emerging adults. Using both conventional Cross-Lagged Panel Models (CLPM) and Random Intercept Cross-Lagged Panel Models (RI-CLPM), we were able to examine both between-person and within-person associations across three measurement waves.

Our findings confirmed that GD severity was consistently and positively correlated with all assessed motivational factors, in line with H1. This replicates prior cross-sectional evidence that gaming motivations are central to problematic gaming (Bäcklund et al., 2022; Király et al., 2022). At the longitudinal level, compensation-related motivations such as Coping and Escape showed reciprocal lagged associations with GD, indicating a delayed but mutually reinforcing dynamic. Introjected Regulation displayed reciprocal effects in CLPM but not in RI-CLPM, suggesting that these effects reflected between-person differences rather than within-person temporal processes. In contrast, gratification-related motivations (Fantasy and Identity) did not significantly predict subsequent GD severity, and thus H2a and H2b were not supported.

Interpretation of unsupported hypotheses

The absence of longitudinal effects for Fantasy and Identity suggests that gratification motivations, though common entry points into gaming, are not sufficient to explain escalation toward GD. This interpretation aligns with I-PACE, which posits that most players start for gratification, but only a subset transition to compensation-driven play and disorder. In other words, playing for gratification may be a near-universal starting point, but it does not by itself constitute a risk factor for disordered play. Our results therefore refine the role of gratification: it may set the stage for initial engagement but does not reliably predict problematic progression.

This pattern is consistent with broader longitudinal findings on gaming involvement. For example, research on general gaming time has produced similarly mixed results: some studies reported that gaming involvement predicted later GD (Brunborg, Mentzoni, & Frøyland, 2014; Rehbein & Baier, 2013), whereas CLPM-based studies failed to confirm such prospective effects (Lemmens, Valkenburg, & Peter, 2011; Teng, Pontes, Nie, Griffiths, & Guo, 2021). These inconsistencies highlight the difficulty of disentangling causal processes in GD. From this viewpoint, oversimplified correlational approaches, although intuitively appealing, are insufficient to capture the dynamic interplay underlying the development of GD. What is needed are more comprehensive longitudinal investigations that model these processes with sufficient temporal depth and theoretical nuance, in order to clarify how motivational changes intersect with other psychological and contextual influences over time.

Theoretical implications

The reciprocal lagged effects observed for Coping and Escape align with I-PACE by highlighting compensation as a central dynamic in the escalation of GD. Notably, these effects appeared with a delay, suggesting that compensatory motivations and GD reinforce each other gradually rather than immediately, pointing to a cumulative process over time. Following recent interpretations of the I-PACE model, this process involves an interaction between pre-existing motivations, situation-specific experiences, and cognitive biases. While our study focused on usage motives, these are functionally linked to experiences of gratification and compensation that occur during gaming, which act as key reinforcement mechanisms. The strengthening of Coping and Escape motives over time likely reflects an increase in relief-oriented "must-do" pathways, where the behavior is increasingly used to alleviate negative affective states rather than solely for pleasure.

It is worth noting that our findings may be also interpreted in the context of Regulatory Focus Theory (Higgins, 2001), which has been introduced into gaming studies by Stenseng (Stenseng, Rise, & Kraft, 2012). We found a positive lagged association between GD and motivations rooted in a prevention focus, but not those rooted in a promotion focus. This distinction is consistent with the latest I-PACE specifications, which emphasize that individuals in later stages of addiction may exhibit altered punishment sensitivity and a shift toward avoidance-based goals.

At a more contextual level, the timing of our data collection may also have influenced the observed dynamics. Participants were first-year university students, and each wave coincided with a distinct stage of the academic year: immediately after the winter exam session (T1), during summer holidays (T2), and shortly before the winter exam session (T3). It is plausible that fluctuating academic stress and relief shaped the prominence of compensatory motivations. Such contextual influences are consistent with I-PACE, which emphasizes the interaction between environmental stressors and individual predispositions in driving addictive behaviors. Furthermore, as highlighted by Brand et al. (2025a, b), situational factors like stress can acutely reduce executive control, making individuals more vulnerable to cue-induced compensatory urges. Additionally, it emphasizes the need to closely examine and describe the overall situation of participants (such as major political or social factors occurring during the longitudinal research period) if these factors affect them as a group.

Beyond theoretical implications, this study offers methodological contributions. By directly comparing CLPM and RI-CLPM, we demonstrated that conventional cross-lagged approaches may conflate stable between-person differences with within-person change, leading to potentially misleading inferences (Hamaker et al., 2015). In our analyses, reciprocal associations between Coping/Escape and GD were consistently observed across both CLPM and RI-CLPM, substantially strengthening confidence in these effects. In contrast, the reciprocal pattern involving Introjected Regulation disappeared once between-person variance was controlled for. This contrast highlights Coping and Escape as the most robust dynamic predictors of GD severity in our sample and exemplifies the importance of model choice in longitudinal gaming research.

Strengths and limitations

Several limitations should be acknowledged. First, our study included only three measurement waves. A greater number of time points would allow for more precise modeling of intraindividual change. Second, because little is currently known about the temporal pace of motivational processes in

GD, we chose a three-month interval as a reasonable starting point. While this design provided valuable insights, future studies should examine whether shorter or longer intervals might capture additional dynamics and thereby enrich our understanding of how these processes unfold over time. Third, the a priori power analysis was based on correlations rather than cross-lagged SEM effects, which may have overestimated sensitivity to small cross-lagged paths. Future studies with larger samples or simulation-based sensitivity analyses could provide a more accurate benchmark for evaluating longitudinal associations. Fourth, our sample consisted of Polish emerging adults, limiting generalizability to other age groups, cultures, or contexts. Finally, although the I-PACE model emphasizes the interaction of individual predispositions and environmental stressors, we did not measure moderators such as depressive symptoms, perceived stress, or social support, which may have shaped the observed associations.

Despite these limitations, the study has several notable strengths. It is based on a large and diverse sample of emerging adults, a developmental stage marked by transitions and heightened vulnerability to problematic gaming. It is also among the first to apply the recently developed Comprehensive Gaming Motivation Model (Király et al., 2022) within a longitudinal framework. Critically, the comparison between CLPM and RI-CLPM provides methodological insights that are seldom addressed in gaming research, highlighting the necessity of carefully distinguishing between stable differences and dynamic processes.

Future studies should extend this work by including more frequent and numerous measurement occasions, testing the robustness of our findings across different cultural and developmental groups, and incorporating potential moderators such as academic stress or mental health indicators.

CONCLUSIONS

In conclusion, our findings support the I-PACE model by demonstrating that compensation-related motivations (Coping, Escape) are reciprocally associated with GD, forming a delayed feedback loop that fuels escalation. At the same time, the lack of longitudinal effects for gratification motivations clarifies their role as near-universal entry points into gaming rather than direct predictors of disorder. By integrating a novel motivational model with advanced longitudinal methods, our study refines theoretical perspectives on the development of GD and underscores the importance of distinguishing between stable between-person differences and dynamic within-person processes.

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SUPPLEMENTARY MATERIAL

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REFERENCES

Arnett, J. J. (2000). Emerging adulthood: A theory of development from the late teens through the twenties. *American Psychologist*, *55*(5), 469.

Bäcklund, C., Elbe, P., Gavelin, H. M., Sörman, D. E., & Ljungberg, J. K. (2022). Gaming motivations and gaming disorder symptoms: A systematic review and meta-analysis. *Journal of Behavioral Addictions*, *11*(3), 667–688.

Brand, M., Antons, S., Bőthe, B., Demetrovics, Z., Fineberg, N. A., Jimenez-Murcia, S., … Potenza, M. N. (2025a). Current advances in behavioral addictions: From fundamental research to clinical practice. *American Journal of Psychiatry*, *182*(2), 155–163.

Brand, M., Müller, A., Wegmann, E., Antons, S., Brandtner, A., Müller, S. M., … Potenza, M. N. (2025b). Current interpretations of the I-PACE model of behavioral addictions. *Journal of Behavioral Addictions*, *14*(1), 1–17.

Brand, M., Wegmann, E., Stark, R., Müller, A., Wölfling, K., Robbins, T. W., & Potenza, M. N. (2019). The interaction of person-affect-cognition-execution (I-PACE) model for addictive behaviors: Update, generalization to addictive behaviors beyond internet-use disorders, and specification of the process character of addictive behaviors. *Neuroscience & Biobehavioral Reviews*, *104*, 1–10.

Brand, M., Young, K. S., 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.

Brunborg, G. S., Mentzoni, R. A., & Frøyland, L. R. (2014). Is video gaming, or video game addiction, associated with depression, academic achievement, heavy episodic drinking, or conduct problems? *Journal of Behavioral Addictions*, *3*(1), 27–32.

Demetrovics, Z., Urbán, R., Nagygyörgy, K., Farkas, J., Zilahy, D., Mervó, B., … Harmath, E. (2011). Why do you play? The development of the motives for online gaming questionnaire (MOGQ). *Behavior Research Methods*, *43*(3), 814–825.

Faul, F., Erdfelder, E., Buchner, A., & Lang, A. G. (2009). Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods*, *41*(4), 1149–1160.

Hamaker, E. L., Kuiper, R. M., & Grasman, R. P. (2015). A critique of the cross-lagged panel model. *Psychological Methods*, *20*(1), 102.

Higgins, E. T., Friedman, R. S., Harlow, R. E., Idson, L. C., Ayduk, O. N., & Taylor, A. (2001). Achievement orientations from subjective histories of success: Promotion pride versus prevention pride. *European Journal of Social Psychology*, *31*(1), 3–23.

Kardefelt-Winther, D. (2014). A conceptual and methodological critique of internet addiction research: Towards a model of compensatory internet use. *Computers in Human Behavior*, *31*, 351–354.

Kenny, D. A., Kaniskan, B., & McCoach, D. B. (2015). The performance of RMSEA in models with small degrees of freedom. *Sociological Methods & Research*, *44*(3), 486–507.

Király, O., Billieux, J., King, D. L., Urbán, R., Koncz, P., Polgár, E., & Demetrovics, Z. (2022). A comprehensive model to understand and assess the motivational background of video game use: The gaming motivation inventory (GMI). *Journal of Behavioral Addictions*, *11*(3), 796–819.

Király, O., Koncz, P., Griffiths, M. D., & Demetrovics, Z. (2023). Gaming disorder: A summary of its characteristics and aetiology. *Comprehensive Psychiatry*, *122*, 152376.

Lemmens, J. S., Valkenburg, P. M., & Peter, J. (2011). The effects of pathological gaming on aggressive behavior. *Journal of Youth and Adolescence*, *40*(1), 38–47.

Orth, U., Clark, D. A., Donnellan, M. B., & Robins, R. W. (2021). Testing prospective effects in longitudinal research: Comparing seven competing cross-lagged models. *Journal of Personality and Social Psychology*, *120*(4), 1013–1034.

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.

Qi, D., Li, X., & Zhu, S. (2025). Unpacking the myth in the associations between self-control and gaming disorder in children and adolescents: A comparison between traditional and random intercept cross-lagged panel model analyses. *International Journal of Mental Health and Addiction*, *23*(5), 3333–3347. https://doi.org/10.1007/s11469-024-01294-0

R Core Team. (2024). *R: A language and environment for statistical computing*. R Foundation for Statistical Computing. https://www.r-project.org/.

Rehbein, F., & Baier, D. (2013). Family-, media-, and school-related risk factors of video game addiction: A 5-year longitudinal study. *Journal of Media Psychology: Theories, Methods, and Applications*, *25*(3), 118–128.

Robinson, T. E., & Berridge, K. C. (2025). The incentive-sensitization theory of addiction 30 years on. *Annual review of Psychology*, *76*.

Rosseel, Y. (2012). Lavaan: An R package for structural equation modeling. *Journal of Statistical Software*, *48*(2), 1–36.

Schivinski, B., Brzozowska-Woś, M., Buchanan, E. M., Griffiths, M. D., & Pontes, H. M. (2018). Psychometric assessment of the internet gaming disorder diagnostic criteria: An item response theory study. *Addictive Behaviors Reports*, *8*, 176–184.

Schulenberg, J. E., & Maggs, J. L. (2002). A developmental perspective on alcohol use and heavy drinking during adolescence and the transition to young adulthood. *Journal of Studies on Alcohol, Supplement*, (14), 54–70.

Stenseng, F., Rise, J., & Kraft, P. (2012). Activity engagement as escape from self: The role of self-suppression and self-expansion. *Leisure Sciences*, *34*(1), 19–38.

Strojny, P., Kiszka, P., Zajas, A., Starzec, S., Szyszka, P. D., & Strojny, A. (2024). Internet gaming disorder and compensation-based gaming motivations: A longitudinal study of emerging adults (preregistration). *Open Science Framework*. https://doi.org/10.17605/OSF.IO/2UQWR

Teng, Z., Pontes, H. M., Nie, Q., Griffiths, M. D., & Guo, C. (2021). Depression and anxiety symptoms associated with internet gaming disorder before and during the COVID-19 pandemic: A longitudinal study. *Journal of Behavioral Addictions*, *10*(1), 169–180.

Teng, Z., Pontes, H. M., Nie, Q., Xiang, G., Griffiths, M. D., & Guo, C. (2020). Internet gaming disorder and psychosocial well-being: A longitudinal study of older-aged adolescents and emerging adults. *Addictive Behaviors*, *110*, 106530.

Wang, H. Y., & Cheng, C. (2022). The associations between gaming motivation and internet gaming disorder: Systematic review and meta-analysis. *JMIR Mental Health*, *9*(2), e23700.

Wang, P., Pan, R., Wu, X., Zhu, G., Wang, Y., Tian, M., … Wang, J. (2022). Reciprocal associations between shyness, depression, and internet gaming disorder among Chinese adolescents: A cross-lagged panel study. *Addictive Behaviors*, *129*, 107256. https://doi.org/10.1016/j.addbeh.2022.107256

Wegmann, E., Knorr, A., Antons, S., & Brand, M. (2025). Systematic review about gratification and compensation in addictive behaviors: Key mechanisms which deserve more attention in addiction research. *Current Addiction Reports*, *12*(1), 50.

Wise, R. A., & Koob, G. F. (2014). The development and maintenance of drug addiction. *Neuropsychopharmacology*, *39*(2), 254–262.

Ye, X., Fong, T. C. T., & Yip, P. S. F. (2025). A cross-lagged panel network model on internet gaming disorder and depressive symptoms concerning preferences for game genres. *Journal of Affective Disorders*, *375*, 27–34.

Yee, N. (2006). Motivations for play in online games. *Cyber Psychology & Behavior*, *9*(6), 772–775.

Zhou, J., Zhao, H., Wang, L., & Zhu, D. (2023). The vicious cycle of family dysfunction and problematic gaming and the mediating role of self-concept clarity among early adolescents: A within-person analysis using random intercept cross-lagged panel modeling. *Journal of Behavioral Addictions*, *12*(4), 920–937. https://doi.org/10.1556/2006.2023.00054