Advances in Educational Technology and Psychology (2026)
Clausius Scientific Press, Canada
DOI: 10.23977/aetp.2026.100306
ISSN 2371-9400 Vol. 10 Num. 3

Game Design Mechanisms Associated with Loss of Control among Adolescents: A Mixed-Methods Study from a Motivational Perspective

Chang Wenliang

HD Beijing School, Chaoyang District, Beijing, 100024, China

Keywords: Game Design Mechanisms; Disordered Gaming Behavior; Adolescents; Learning Motivation; Mixed-Methods Research

Abstract: Research on adolescent gaming behavior has long focused on the association between gaming duration and pathological symptoms, while neglecting the structural influence of game design mechanisms themselves. Using a mixed-methods design, this study examines the relationships between three typical game mechanics, gacha/random rewards, consecutive check-ins, and competitive ranking systems, and adolescents' disordered gaming behavior, based on 54 questionnaires and 4 in-depth interviews. Three key findings emerge: First, distinct mechanics show differentiated associations with core dimensions of Internet Gaming Disorder (IGD): gacha mechanisms primarily induce emotional dependence and compulsive repetition; ranking systems most strongly drive uncontrolled persistence and emotional volatility; and check-in mechanisms shape habitual login through loss aversion. Second, loss of control is not a persistent trait but a contextually activated episodic response, triggered by academic pressure, social deficiency, and other situational factors. Third, gaming and learning constitute an asymmetric competition within the motivational system, marked by a stark contrast between immediate rewards in games and delayed outcomes in academic learning. This study proposes a shift from the "games-are-harmful" narrative to a "mechanism-sensitivity" perspective, providing empirical support for family education, school design, and industry regulation.

1. Introduction

Digital games have become a routine part of adolescents' daily lives [1]. However, public and academic discourse has long been trapped in a simplified framework: gaming problems are attributed to "poor self-control" or "excessive playtime", ignoring the structural role of game design itself. In 2025, a study by the Department of Psychological Medicine, Children's Hospital of Nanjing Medical University noted that gaming addiction among minors arises from "the interaction between developmental traits, game design mechanisms, and psychosocial needs" [2]. This insight urges us to shift from asking whether adolescents should play games to how specific game mechanics interact with the developing self-control system.

Internet Gaming Disorder (IGD) was included in DSM-5 as a "condition for further study" in 2013, and gaming disorder was formally incorporated into ICD-11 by the World Health

Organization in 2018. Nevertheless, existing diagnostic systems adopt "flat, cross-sectional definitions" that fail to capture the developmental progression of gaming disorder "from excitement to compulsion" [3]. A more critical question remains: Do different game design mechanisms correspond to distinct symptom dimensions of IGD? Are there qualitative differences in how gacha mechanics and ranking systems contribute to loss of control?

This study revisits these questions from a motivational perspective. We argue that IGD-related symptoms, uncontrolled use, time distortion, and mood regulation, should not be interpreted merely as pathological outcomes, but as reflections of a motivational asymmetry between gaming and learning environments. Games provide immediate feedback, clear goals, and emotionally salient rewards, whereas academic learning typically involves delayed outcomes and high uncertainty [4]. This structural disparity may systematically shift adolescents' motivational preferences.

Accordingly, this study addresses three research questions:

RQ1: Do different game design mechanisms show differentiated associations with core symptom dimensions of IGD?

RQ2: How do adolescents subjectively experience these mechanisms in terms of motivation, self-control, and behavioral consequences?

RQ3: How do individual differences and situational factors moderate the relationship between mechanic exposure and loss-of-control behavior?

2. Literature Review and Research Framework

2.1 Gaming Disorder: From Diagnostic Classification to Motivational Understanding

The core feature of gaming disorder is "uncontrolled use of games": individuals lose control over the initiation, termination, frequency, and duration of gaming, and continue despite awareness of harm. Neuroscience research reveals that adolescence is the peak period for gaming disorder, directly linked to delayed prefrontal cortex maturation and hyperactive dopamine systems: when exposed to game rewards, reward regions in the adolescent brain are approximately 40% more active than in adults.

A psychophysiological study by Caroline et al. (2024) [5] further found that skin conductance responses during loot-box openings resemble patterns observed in gambling, suggesting that random reward mechanisms strengthen neural memory circuits via "reward prediction error".

However, most existing research treats IGD as a homogeneous construct, rarely asking: Do the three core dimensions, loss of control, time distortion, and emotional dependence, correspond to different game mechanics? The "clinical staging model" proposed by Van et al. (2020) [6] offers inspiration: gaming disorder exists on a continuum from "high excitement" to "high compulsion". Different mechanisms may play distinct roles in this progression: random rewards mainly drive excitatory engagement, while ranking systems reinforce compulsive persistence.

2.2 Behavioral Reinforcement Logic of Game Design Mechanisms

Random Reward Mechanisms (Gacha/Loot Boxes) operate on variable-ratio reinforcement schedules. Behavioral psychology demonstrates that uncertainty is the strongest driver of repetitive behavior; seeking behavior is maximized when rewards appear unpredictably [7]. Experiments confirm that skin conductance responses during loot-box openings are significantly higher than during regular gameplay, indicating measurable physiological arousal.

Consecutive Check-In Mechanisms exploit loss aversion. Once a streak is established, "breaking the streak" constitutes a psychological loss. This design transforms intrinsically motivated play into a "sense of obligation", leading users to log in "just for a moment" even when they have no time to

play. From a motivational standpoint, this represents a typical design that converts autonomous play into coercive habit [8].

Ranking and Competitive Mechanisms activate social comparison and self-identity. Visible symbols such as ranks, tiers, and points bind game progress to external evaluation. The urge to "win back" after a loss is essentially compensatory effort to repair threatened self-worth [9]. As interviewees reported, "Losing makes me keep playing; it makes me irritable and unable to study".

2.3 Motivational Asymmetry between Gaming and Learning Environments

Research on gamified learning reveals a key insight: learners with high gaming experience show stronger intrinsic motivation, positive affect, and learning outcomes, while those with low gaming experience rely more on external motivation [10]. This suggests that gaming experience shapes motivational preferences. The problem arises when gaming and learning environments differ systematically in feedback structure, leading to "motivational transfer difficulties".

Gaming environments are characterized by immediate feedback (every action elicits a response), clear goals (hierarchical tasks), and emotional salience (audio-visual effects amplify rewards). In contrast, learning environments typically feature delayed feedback (outcomes emerge after weeks or months), ambiguous goals (standards of "mastery" are hard to quantify), and emotional flatness (lack of instant reinforcement). This structural disparity means that adolescents frequently exposed to game reinforcement may show reduced patience for learning, not from a lack of motivation, but because their motivational systems are calibrated to expect "game-style feedback" [11].

3. Methodology

3.1 Mixed-Methods Design

This study employs an explanatory sequential mixed-methods design. In the first phase, a questionnaire survey (N=54) measures exposure to game mechanics, IGD symptom dimensions, and perceived learning motivation. In the second phase, semi-structured in-depth interviews (N=4) are conducted with selected typical cases to trace the full chain: mechanic exposure - subjective experience - behavioral consequences. This design identifies general patterns while capturing individual meaning-making processes.

3.2 Participants

Questionnaire participants were students from Grades 7 to 12, yielding 54 valid responses via convenience sampling. The sample included 31 males (57.4%) and 23 females (42.6%), covering Grades 7 through 12. Interview participants were selected from questionnaire respondents to ensure coverage of different mechanic exposure types and IGD symptom levels, with four cases included for in-depth analysis.

3.3 Measures

First, a self-developed Game Mechanic Exposure Scale measures exposure and behavioral responses to three core mechanics: gacha/random rewards, consecutive check-ins, and ranking/tier systems, using a 5-point Likert scale.

Second, IGD Symptom Dimensions are operationalized based on the DSM-5 framework, focusing on three core components, namely Loss of Control (e.g., "I play longer than planned", "I fail to reduce playtime"), Time Distortion (e.g., "I lose track of time", "I delay important tasks"),

and Emotional Dependence (e.g., “I feel restless when unable to play”, “I play to relieve negative emotions”)

Third, a self-developed Learning Motivation Comparison Scale measures perceived differences between gaming and learning in feedback speed, achievement, focus, and behavioral choice, with eight items rated on a 5-point scale.

3.4 Interview Design and Analysis

Interviews used a semi-structured protocol, with sequential questions for each mechanic: exposure, immediate subjective experience, behavioral consequences (duration, stopping ability), and post-hoc reflection. Situational factors (academic pressure, timing, social context) and protective alternative activities (sports, reading) were also explored. All interviews were audio-recorded and transcribed, and thematic analysis was used for coding.

4. Results

4.1 Differentiated Effects of Game Mechanisms

4.1.1 Gacha/Random Rewards: Emotional Dependence and Compulsive Repetition

Questionnaire data show that respondents who “repeatedly try for better rewards” (Q6) also frequently endorsed “using games to relieve stress” (Q19) and “feeling restless when unable to play” (Q18), indicating a strong link between random rewards and mood regulation. One interviewee described a typical experience: “After getting a reward, I want to use it to keep playing”, rewards do not satisfy but fuel further seeking.

Neuropsychological accounts explain this pattern: random rewards activate the dopamine system via reward prediction error, not from the reward itself. This mechanism locks users in a cycle: anticipation - attempt - disappointment or brief satisfaction - re-anticipation. Notably, arousal is tied to uncertainty, not reward magnitude.

4.1.2 Ranking Systems: Uncontrolled Persistence and Emotional Volatility

Among all mechanics, ranking systems were repeatedly identified as “most addictive”. One participant who played 12 hours weekly stated: “Losing repeatedly in Honor of Kings makes me addicted; I keep trying to win back”. Another added: “Losing makes me play nonstop; it makes me irritable and unable to study”. This pattern reflects compensatory effort to repair threatened self-worth.

Ranking systems bind outcomes to visible social symbols (tiers, ranks). When adolescents lack competence in real life, game rankings become an alternative source of identity. The study finds that ranking systems are strongly associated with “emotional impact from results” (Q13) and “urge to continue after losing” (Q12). One interviewee distinguished mechanisms clearly: “Losing points is most addictive; I keep playing to maintain my rank, it’s the easiest to lose control over”.

Notably, ranking-induced loss of control is contextually triggered. Multiple respondents reported that loss of control occurred mainly after losing streaks: “Winning gives brief joy; losing leaves me upset”. This asymmetry shows that the risk of ranking systems lies not in gaming itself, but in amplifying frustration.

4.1.3 Consecutive Check-Ins: Habit Formation and Loss Aversion

Check-in mechanics operate differently: they do not pursue intense emotion but shape habitual

login through loss avoidance. One participant stated: “I log in just to check in even if I have no time to play”. Motivation is no longer intrinsic interest but avoidance of loss.

From self-determination theory, check-ins transform autonomous play into obligatory tasks. Play shifts from “I want to play” to “I must log in”. This shift erodes positive value; interviewees described “emptiness after playing”, a typical outcome of depleted intrinsic motivation.

4.2 Contextuality of Loss of Control: Episodic Rather Than Chronic

A core finding is that loss of control is not a stable trait but a contextually activated episodic response, consistent with clinical staging models [12].

Multiple respondents reported that loss of control mainly occurred “after exams” or “when finished with schoolwork”. One participant who played 5 hours weekly noted: “When free from studies, I plan 1–2 hours but end up playing 4 hours with friends”. Conversely, gaming was restrained under high academic pressure, showing that academic pressure acts as both a trigger (escape) and a constraint (time limit).

Second, online multiplayer strongly amplifies risk. One interviewee noted: “Playing with friends never ends; it’s easy to lose control”. Another reported: “Playing with friends at night, I lose track of time until it’s very late”. Social interaction strengthens immersion while weakening time perception and stopping ability.

Third, loss of control is more common at night, likely due to depleted self-regulatory resources after daytime learning. One participant described his worst episode: “I planned to stop at 11 PM but kept playing until exhausted”. These findings highlight the importance of targeting high-risk situations rather than general bans.

4.3 Motivational Asymmetry between Gaming and Learning

4.3.1 Feedback Speed and Achievement

All respondents acknowledged fundamental differences in feedback structures. One summarized: “Games give fast feedback and are fun; learning takes long, progress is uncertain, and it’s tough”. Another noted: “In games, I know right away if I’m doing well; in studying, I wait a long time to see results”.

This disparity causes motivational preference shift. Adolescents exposed to immediate rewards show reduced patience for delayed academic outcomes, but not from lack of motivation. Interviewees explicitly confirmed: “I can still enjoy delayed satisfaction from learning”, though it is far more difficult than in games.

4.3.2 Multifaceted vs. Unitary Achievement

Games offer diverse achievement sources: ranks, gear, points, and social approval. Learning achievement is relatively unitary, centered on grades and ratings. One respondent noted: “Games have many rewards; comparing ranks with friends is direct. Learning only has grades, achievement is narrow”.

This contrast has educational implications: when adolescents experience multifaceted feedback in games but only one-dimensional feedback in learning, motivation naturally favors games. This is not evidence of “corruption” but a motivational design disadvantage in learning environments.

4.3.3 Cognitive Switching Cost from Gaming to Learning

Many respondents reported that “switching from games to studying is difficult”. One described:

“Playing briefly during homework breaks distracts my focus; I can’t concentrate again”. Another added: “Gaming before bed overstimulates me and harms sleep”. Switching difficulty stems from attentional residue and emotional carryover: the arousal of games conflicts with the calm focus required for learning.

Notably, switching difficulty varies by mechanic: it is mild after check-ins but severe after losing a ranked match. Ranking systems may produce more persistent emotional “spillover effects” [13].

4.4 Protective Factors and Generational Differences

4.4.1 Buffering Effects of Alternative Activities

Interviewees spontaneously mentioned alternative activities that reduce gaming urges. One noted: “Reading novels relieves stress less effectively but has fewer negative effects”. Another reported: “Sports, Lego, and music shift my attention”. These activities provide immersion without game-style reinforcement.

Effectiveness varies by exposure level: alternatives nearly eliminate urges in light gamers (3 hours/week) but only partially relieve heavy gamers (12 hours/week). Early diversification of interests may have preventive value.

4.4.2 Moderating Effects of Age and Development

Multiple respondents contrasted past and present gaming experiences. A 9th-grader recalled: “As a kid, leveling up made me lose control; I doubled my playtime to reach the next tier”. Now, “I’ve lost interest”. Another stated: “As a kid, I obsessed over characters and gear; now I know games are virtual”.

These reports align with prefrontal cortex development: impulse control and long-term planning improve with age, reducing sensitivity to game reinforcement. This suggests that early adolescence is the most sensitive period and the optimal window for intervention.

5. Discussion

5.1 From “Games Are Harmful” to “Mechanism Sensitivity”: A Conceptual Shift

The core contribution of this study is shifting debate from whether games are harmful to which mechanics pose risks to whom under what conditions. This shift has three implications:

Firstly, games are heterogeneous: Different mechanisms act on distinct psychological processes, gacha activates reward systems, rankings activate social identity, and check-ins shape habit loops. Treating “games” as a single unit obscures critical differences. Secondly, individuals are heterogeneous. The same mechanic affects people differently, based on development, context, and self-control. Identifying moderators enables precision intervention. Thirdly, environments interact. Mechanic effects depend on real-life conditions. Risks rise when autonomy, competence, and belonging are unmet offline; risks are buffered when real-life satisfaction is sufficient. Intervention must target both gaming and real-life contexts.

5.2 Motivational Reflections on Learning Environment Design

Findings inform educational design: if games excel at immediate feedback, clear goals, and diverse achievement, learning environments should adopt these principles rather than condemning games.

Learning can increase process feedback to reduce anxiety from delayed outcomes: quizzes,

instant feedback, and progress visualization narrow the motivational gap. Games use hierarchical tasks; learning can decompose long-term goals into actionable short-term steps. Grades need not be the only metric: recognizing collaboration, creativity, and persistence expands achievement sources and reduces reliance on game-based substitutes.

5.3 Practical Implications for Family Intervention

Family strategies can be revised as follows. The first is to shift from time management to mechanic dialogue: Instead of limiting daily duration, discuss which mechanics make stopping hardest. This improves communication and self-awareness. The second is to shift from power struggles to situational awareness: Help adolescents recognize high-risk situations (post-exam, nighttime, multiplayer) and build pre-emptive strategies, rather than retroactive punishment. The third is to shift from prohibition to alternative building: Banning games without alternatives causes withdrawal and rebound. Supporting offline activities (sports, arts, socializing) that provide comparable immersion is more sustainable.

5.4 Industry Standards and Policy Recommendations

Findings also guide game design and regulation: random rewards, ranking systems, and check-ins are not inherently harmful but require age-appropriate boundaries.

The first is transparency, disclose odds, matching rules, and long-term impacts to enable informed choice. The second is protective design: Implement caps on gacha pulls, loss-protection in ranked matches, and streak forgiveness for minors. The third is cross-sector collaboration: Industry, education, and mental health professionals should share insights, treating adolescent gaming as a shared societal challenge rather than a source of blame [14].

6. Conclusion

Based on 54 questionnaires and 4 in-depth interviews, this study investigates relationships between game design mechanisms and adolescents' disordered gaming. Three main conclusions emerge.

The first is Differentiated Associations. Gacha/random rewards drive emotional dependence and compulsive repetition; ranking systems most strongly cause uncontrolled persistence and emotional volatility; check-ins shape habitual login via loss aversion. Gaming research must move beyond coarse "duration" or "addiction" frameworks to fine-grained mechanic analysis.

The second is Contextual Loss of Control. Loss of control is not chronic but situationally activated by academic pressure, social context, and timing. Intervention should target high-risk situations, not blanket restriction.

The third is Motivational Asymmetry. Gaming and learning compete asymmetrically: immediate feedback, clear goals, and diverse achievement in games contrast with delayed feedback, ambiguous goals, and narrow achievement in academics. This structural disparity explains motivational preference without moralistic appeals to "poor self-control".

Limitations include a relatively small sample and cross-sectional design, which preclude causal inference. Future research may combine longitudinal tracking and psychophysiological measurement to clarify dynamic mechanisms. Nevertheless, this study establishes that attributing gaming problems solely to individual self-control is inconsistent with developmental neuroscience and ineffective for intervention. Understanding the structural role of game design mechanics, and identifying risks and protective factors in real-life contexts, provides robust support for healthy adolescent development.

References

[1] Geoffrey, E., & Isaac, S. (2026). Building Blocks of Tabletop Game Design:An Encyclopedia of Mechanisms. CRC Press.

[2] Shane, D. S. (2026). Mechanism Design in Sport Matches: Competitive Balance, Intermediate Targets, and Effort Elicitation in a Three-Stage Contest Game. American Behavioral Scientist, 70(1), 3-14.

[3] Deng, H. M. (2023). Research on the Design of Learning Motivation Stimulation Mechanism in Educational Games. International Journal of New Developments in Education, 5(17).

[4] Tang, H. N. et al. (2024). When Games Influence Words: Gaming Addiction among College Students Increases Verbal Aggression through Risk-Biased Drifting in Decision-Making. Behavioral Sciences, 14(8), 699.

[5] Caroline, C. et al. (2024). Momentary Associations Across Specific Affective States and Dysregulated Eating Experiences Among Children and Adolescents With Loss of Control Eating Symptoms. The International journal of eating disorders, 58(3), 542-553.

[6] Van, M. E. et al. (2020). Multi-method evidence for a dual-pathway perspective of self-regulation in loss of control over eating among adolescents. Appetite, 153.

[7] Alidosti, M. et al. (2020). Design and evaluation of two educational media in the form of animation and games to promote the cutaneous leishmaniasis prevention behaviors in adolescent female. BMC Public Health, 22(1).

[8] Andrew, L. et al. (2020). Serious games for health promotion in adolescents - a systematic scoping review. Education and information technologies, 28(5), 31-32.

[9] Ufiiana, E. et al. (2021). Correlation of Online Game Addiction Battle Arena Online Multiplayer (MOBA) Toward Aggressive Behavior in Adolescent. Journal of Computational and Theoretical Nanoscience, 18(1), 291-296.

[10] Federico, A. L. et al. (2025). Video Games and Mental Health:Perspectives of Psychology and Game Design. Transcript Verlag.

[11] Eliana. A., & Richard, A. (2025). A Narrative Review of the Benefits of Board Games in Health. Cureus, 17(9).

[12] Shaina, G., & Alexia, G. (2025). Advancements and challenges in methodological approaches for game-based health interventions: a scoping review. Frontiers in Digital Health, 7.

[13] Huang, H., Yu, H., & Li, W. W. (2024). Assessing the Importance of Content Versus Design for Successful Crowdfunding of Health Education Games: Online Survey Study. JMIR serious games, 12.

[14] Kevin, R. G., & Alec, B. (2021). Learner-centric Design of a Hand Hygiene Serious Simulation Game for Grade 12 Emerging Health Professional Students. TechTrends, 65, 379–393.