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Mechanisms of Family Interventions on Adolescent Gaming Addiction: The Mediating Roles of Autonomy Support and Psychological Reactance

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Abstract: This study investigates how diverse family intervention strategies influence adolescent gaming addiction through underlying psychological mechanisms. A structural equation model was developed using autonomy support and psychological reactance as mediators, and parent-child relationships as moderators. Data from 2,419 secondary school students were analyzed via SmartPLS. Results indicate that active assistance mitigates gaming addiction by enhancing autonomy support and reducing psychological reactance, whereas permissiveness, restrictive constraint, and monitoring exacerbate addiction indirectly by weakening autonomy or intensifying reactance. Co-playing observation produced offsetting mediations, reflecting its dual activation of psychological processes. Moreover, father-child and mother-child relationships demonstrated opposite moderating effects on the autonomy - addiction path. The study advances theoretical understanding of family-based media behavior regulation and provides empirical guidance for evidence-based interventions promoting adolescents' digital well-being.

Keywords: Family intervention; Adolescent gaming addiction; Autonomy support; Psychological reactance; Parent-child relationship

1 Introduction

In the digital era, gaming has become an integral part of adolescents' everyday lives, offering immersive experiences, instant feedback, and social interaction. Yet, excessive engagement can lead to uncontrolled use, escapism, and emotional dependence — hallmarks of gaming addiction. Such behaviors undermine learning motivation, social relationships, and mental health, posing a significant developmental risk for adolescents. Within this context, the family represents the primary environment shaping adolescents' media behavior. Parental attitudes, intervention strategies, and

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emotional support critically influence how young people perceive and regulate gaming. While supportive approaches that foster autonomy can strengthen self-regulation and reduce addictive tendencies, controlling or dismissive strategies often provoke psychological reactance, leading to a reinforcing cycle of restriction and addiction. Understanding how different family interventions interact with adolescents' psychological mechanisms is thus essential to mitigating gaming-related risks.

Young first introduced the concept of Internet addiction disorder and developed diagnostic criteria based on substance addiction models (Young, 1998). Subsequent research conceptualized Internet addiction as a compensatory behavior stemming from unmet psychological needs (Caplan, 2002). Adolescents, due to their developmental sensitivity, are particularly prone to emotional distress and interpersonal conflict associated with excessive online dependence (Kuss & Griffiths, 2012). Among various online activities, gaming — with its immersive design, instant feedback, and social affordances — has been identified as the most addictive form of engagement (Lemmens et al., 2011). The study of gaming addiction, as a form of maladaptive media behavior, has evolved from behaviorist models to cognitive-behavioral frameworks and, more recently, to social-ecological approaches. This theoretical progression reflects a deepening understanding of addiction mechanisms and a growing recognition that family environment, psychological responses, and social context interact in shaping addictive tendencies.

Since the early 21st century, the cognitive-behavioral model has gained prominence, positing that individuals' cognitive appraisals of gaming situations and their emotional regulation abilities mediate addictive behaviors. Addiction is thus redefined as a functional coping mechanism used to escape from stress, failure, or emotional dysregulation. Yet, this model still struggles to explain why adolescents in similar environments exhibit vastly different gaming tendencies. Consequently, recent research has developed more comprehensive models incorporating family parenting styles, self-determined motivation, and psychological reactance as developmental factors within a systemic framework. From this perspective, the social developmental model conceptualizes adolescent gaming addiction as the dynamic outcome of interactions among family, individual, and social systems. It posits that emotional conflict arising from maladaptive parenting and weakened prosocial norms are critical triggers for excessive gaming. Understanding gaming addiction, accordingly, requires integrating adolescents' psychological development, family intervention patterns, and broader social support structures.

The family, as the primary socializing context, profoundly influences adolescents' media use behaviors. Early research on parental mediation — originally focused on television — identified two principal strategies: restrictive mediation and interpretive discussion (Nathanson, 1999). As authoritarian restriction proved increasingly ineffective, often provoking resistance and defiance among adolescents (Padilla-Walker et al., 2010), scholarly attention shifted toward active mediation and co-regulatory negotiation, emphasizing mutual communication and shared rule-setting (Clark, 2011). In general, family mediation can be categorized into controlling and supportive types (Soenens & Vansteenkiste, 2010), and its effectiveness is shaped by factors such as parent–child attachment, communicative trust, parental education level, and child gender and age (Qi & Mo, 2016). Family mediation is thus not merely behavioral control but a developmental mechanism that fosters adolescents' comprehension and decision-making skills, promoting healthier media use (Lee, 2013). Beyond behavioral regulation, parental mediation also molds adolescents' self-concept, sense of responsibility, and social adaptability.

Within the process of family intervention in Internet and gaming addiction, psychological reactance and autonomy support are pivotal variables determining the success of intervention outcomes. According to Brehm's theory of

psychological reactance (Brehm, 1981), individuals experience motivational arousal when their perceived freedom is threatened. Adolescents, whose need for autonomy is particularly salient, often interpret parental restrictions as suppression, responding with oppositional behaviors such as excessive gaming. High levels of psychological control from parents significantly increase the risk of Internet addiction, often accompanied by low self-efficacy and emotional distress (Kwon et al., 2011). When individuals' fundamental psychological needs for autonomy, competence, and relatedness are chronically thwarted, they are more likely to adopt maladaptive compensatory behaviors. Online games offering controllability, low-cost achievement, and social feedback become an efficient but risky avenue for need fulfillment. Without sufficient real-world support systems, such compensatory engagement can readily evolve into dependency or addiction. A lack of respect for adolescents' autonomy boundaries within families not only undermines mental well-being but also increases the likelihood of escapist media use under stress. Moreover, the manner in which rules are enforced crucially affects the formation of psychological reactance. When parents implement media-use regulations with adequate explanation, emotional validation, and respect for adolescents' perspectives, the likelihood of reactance diminishes considerably.

The quality of the parent–child relationship moderates this dynamic: supportive communication can buffer reactance, whereas cold or authoritarian interaction amplifies it (Ballarotto et al., 2018). When family interactions are characterized by support, respect, and autonomy, adolescents are more emotionally receptive to behavioral guidance, thus raising their tolerance for external regulation. Conversely, emotionally distant or coercive communication fosters perceptions of parental intrusion, eliciting defiant attitudes and behaviors.

The instant feedback and explicit rewards provided by online games may serve as substitutes for adolescents' unmet needs for control and competence. In the absence of real-world autonomy support, such compensatory satisfaction readily transforms into addictive risk. Conversely, autonomy-supportive family environments enable adolescents to cope with challenges constructively and reduce reliance on virtual escapism. Recent studies further affirm the preventive role of autonomy need satisfaction in addiction: individuals with higher levels of psychological need fulfillment exhibit lower gaming addiction tendencies, whereas those with frustrated needs often seek compensation through gaming (Ryan & Deci, 2000). When parents set rules with explanation and empathy, reactance is attenuated. Autonomy-supportive parenting—characterized by offering choices, encouraging self-expression, and negotiating rules—facilitates need satisfaction, in contrast to psychological control (Grolnick & Pomerantz, 2009). Within the family context, autonomy support involves giving adolescents the opportunity to voice opinions, providing choices in decision-making, and guiding behavior through collaboration rather than coercion. This balance between structure and freedom allows adolescents to feel respected and trusted while maintaining behavioral guidance. In contrast, psychologically controlling parenting manipulates emotions and imposes excessive restrictions, undermining autonomy and triggering reactance and maladaptation. Empirical studies have demonstrated that autonomy support significantly reduces Internet and gaming addiction, primarily by enhancing self-regulation and intrinsic motivation (Van Petegem et al., 2015). The negative association between autonomy support and addiction is partially mediated by self-determined motivation (Deng et al., 2022). When real-world autonomy needs are frustrated, adolescents seek control and competence through gaming (Kardefelt-Winther, 2014). Thus, autonomy support exerts both direct protective effects and indirect influences through psychological need satisfaction (Zhang, 2024). Gaming addiction can therefore be understood as the combined outcome of unmet psychological needs, environmental imbalance in support, and motivational misalignment (Kuss & Griffiths, 2012).

2 Research Methods

2.1 Participants

From June to July 2025, data were collected from 13 junior and senior secondary schools in Jinzhong City, Shanxi Province. Using a cluster sampling strategy, two classes were randomly selected from each grade level — Grade 7, Grade 8, Grade 10, and Grade 11. A total of 2,840 questionnaires were distributed through offline administration, and 2,419 valid responses were obtained, yielding an effective response rate of 85.17%.

Among the participants, 1,134 were female (46.9%), 1,280 were male (52.9%), and 5 identified as other (0.2%). By grade, 968 were in Grade 7 (40%), 589 in Grade 8 (24.3%), 381 in Grade 10 (15.8%), and 481 in Grade 11 (19.9%). In terms of family structure, 557 participants were only children (23%), 1,855 were non–only children (76.7%), and 7 did not specify (0.3%). Regarding living arrangements, 792 were day students (32.7%), 1,618 were boarding students (66.9%), and 9 reported other living situations (0.4%).

2.2 Measures

2.2.1 Psychological Reactance

Psychological reactance was measured using the Adolescent Psychological Reactance Questionnaire originally developed by Hong and Faedda (Hong & Faedda, 1996), and revised for Chinese adolescents by Ding (Ding et al., 2011). The scale consists of 15 items, with higher mean scores indicating higher levels of psychological reactance among adolescents.

2.2.2 Parental Autonomy Support

Autonomy support was assessed using the Parental Autonomy Support Questionnaire, adapted from the Parental and Teacher Autonomy Support Scale by Tang (Tang et al., 2013). The instrument includes 12 items, and higher scores represent a stronger perceived sense of autonomy support from parents.

2.2.3 Parental Intervention Strategies

Parental intervention in adolescents' gaming behavior was measured using a combined scale derived from the Parental Mediation of Internet Use Questionnaire, revised by Wu (Wu et al., 2019), and the Parental Mediation Scale of Digital Games for Children (PMSDGC) developed by Gözüm (Gzüm & Kandr, 2020). The integrated questionnaire comprises 26 items across six dimensions, capturing diverse forms of parental mediation behavior.

2.2.4 Gaming Addiction

Gaming addiction was measured by adapting items from the IGDS9-SF (Pontes & Griffiths, 2015) and the IGD-20 Test (Pontes et al., 2014). A total of 13 items were selected to assess the severity of gaming addiction, with higher average scores indicating stronger tendencies toward gaming addiction.

2.2.5 Parent–Child Relationship Closeness

The quality of the parent-child relationship was assessed using the Parent-Child Relationship Closeness Scale,

revised by Zhang (Zhang et al., 2011). The scale distinguishes between father-child and mother-child relationships, with higher scores indicating stronger emotional closeness and better relationship quality.

2.3 Data Analysis

Data were analyzed using SPSS 26.0 for descriptive statistics. For multivariate analyses, SmartPLS 4.0 was employed to perform structural equation modeling (SEM), given its suitability for handling models with both mediating and moderating variables.

To evaluate measurement validity, factor loadings and the average variance extracted (AVE) were used to test convergent validity. Discriminant validity was assessed by ensuring that each latent variable's correlation with itself was greater than its correlation with any other latent variable.

For path analysis and the testing of moderation and mediation effects, a two-tailed significance test was applied, with the alpha level set at 0.05.

3 Results

3.1 Comparison of Scale Scores Across Demographic Groups

A one-way ANOVA further revealed significant between-group differences across grade levels for all variables except autonomy support, indicating that students' grade level had a significant impact on both gaming addiction tendencies and parental intervention strategies (Table 1). These findings suggest that as adolescents advance in schooling, both their gaming behaviors and their parents' mediation patterns vary significantly.

Table 1 Mean Scale Scores of Adolescents by Gender and Grade Level

Variable	Gender				Grade Level					
	Male (*N* = 1280)	Female (*N* = 1134)	*t*	*p*	Grade 7 (*N* = 968)	Grade 8 (*N* = 589)	Grade10 (*N* = 381)	Grade11 (*N* = 481)	*F*	*p*
Gaming Addiction	2.31 ± 0.82	2.29 ± 0.82	0.704	0.746	2.33 ± 0.82	2.32 ± 0.83	2.15 ± 0.79	2.32 ± 0.82	4.800	0.002
Psychological Reactance	1.91 ± 0.74	1.91 ± 0.76	-0.011	0.531	1.98 ± 0.78	1.89 ± 0.76	1.74 ± 0.66	1.96 ± 0.72	10.097	0.001
Autonomy Support	2.88 ± 0.92	2.99 ± 0.89	-3.101	0.169	2.96 ± 0.90	2.87 ± 1.00	2.95 ± 0.91	2.94 ± 0.81	1.323	0.265
Parental Monitoring	2.07 ± 1.04	2.05 ± 1.02	0.407	0.399	2.17 ± 1.04	2.10 ± 1.12	1.74 ± 0.86	2.07 ± 0.97	16.564	0.001
Parental Permissiveness	2.38 ± 0.92	2.45 ± 0.92	-1.853	0.732	2.49 ± 0.92	2.34 ± 0.97	2.32 ± 0.92	2.43 ± 0.85	5.139	0.002
Technical Restriction	2.05 ± 0.91	2.06 ± 0.97	-0.242	0.005	2.15 ± 0.94	2.01 ± 1.01	1.85 ± 0.82	2.08 ± 0.90	10.173	0.001
Active Assistance	3.00 ± 1.02	3.08 ± 1.02	-2.057	0.631	3.07 ± 1.03	2.87 ± 1.10	3.12 ± 1.02	3.12 ± 0.89	7.430	0.001
Restrictive Constraint	2.86 ± 0.93	2.90 ± 0.92	-1.229	0.900	2.93 ± 0.90	2.79 ± 1.04	2.81 ± 0.88	2.94 ± 0.84	4.124	0.006
Co-Playing Observation	2.26 ± 0.88	2.32 ± 0.91	-1.576	0.552	2.32 ± 0.89	2.24 ± 0.96	2.19 ± 0.88	2.37 ± 0.82	4.044	0.007
Mother-Child Relationship	3.35 ± 0.92	3.46 ± 0.89	-2.980	0.288	3.38 ± 0.99	3.31 ± 1.08	3.58 ± 0.60	3.38 ± 0.67	7.329	0.001
Father-Child Relationship	3.17 ± 0.93	3.26 ± 0.92	-2.372	0.517	3.25 ± 0.95	3.12 ± 1.09	3.28 ± 0.73	3.20 ± 0.79	3.027	0.028

3.2 Data Analysis

3.2.1 Reliability and Validity Tests

The measurement model demonstrated satisfactory reliability and validity across all latent constructs. As shown in

Table 2, the Cronbach's α coefficients for each construct exceeded 0.65, and all composite reliability (CR) values were above 0.80, indicating strong internal consistency and construct reliability. Regarding convergent validity, the factor loadings of all observed variables were greater than 0.60, and the average variance extracted (AVE) values for all latent variables exceeded 0.50, suggesting adequate convergence.

Table 2 Reliability and Validity Indices of the Measurement Model

Latent Factors	Observed Variables	Factor Loadings	AVE	C.R	α
Gaming Addiction	GA1	0.817	0.667	0.844	0.834
	GA2	0.816			
	GA3	0.798			
	GA4	0.796			
	GA5	0.792			
	GA6	0.790			
	GA7	0.780			
	GA8	0.777			
	GA9	0.773			
	GA10	0.761			
	GA11	0.751			
	GA12	0.719			
	GA13	0.712			
Psychological Reactance	RP1	0.813	0.735	0.955	0.884
	RP2	0.811			
	RP3	0.801			
	RP4	0.800			
	RP5	0.789			
	RP6	0.771			
	RP7	0.759			
	RP8	0.743			
	RP9	0.740			
	RP10	0.698			
	RP11	0.687			
	RP12	0.686			
	RP13	0.683			
	RP14	0.656			
	RP15	0.676			
Autonomy Support	AS1	0.829	0.646	0.818	0.814
	AS2	0.804			
	AS3	0.787			
	AS4	0.786			
	AS5	0.758			
	AS6	0.750			
	AS7	0.716			
	AS8	0.713			
	AS9	0.690			
	AS10	0.667			
Active Assistance	AA1	0.864	0.648	0.946	0.931
	AA2	0.830			
	AA3	0.805			
	AA4	0.765			
Technical Restriction	TR1	0.928	0.592	0.944	0.942
	TR2	0.888			
	TR3	0.817			
	TR4	0.789			

Continued

Latent Factors	Observed Variables	Factor Loadings	AVE	C.R	α
Parental Permissiveness	PP1	0.865	0.659	0.948	0.934
	PP2	0.850			
	PP3	0.798			
	PP4	0.690			
Restrictive Constraint	RC1	0.862	0.802	0.928	0.918
	RC2	0.852			
	RC3	0.784			
	RC4	0.715			
	RC5	0.671			
	RC6	0.685			
Parental Monitoring	PM1	0.915	0.561	0.921	0.913
	PM2	0.907			
	PM3	0.898			
	PM4	0.862			
Co-playing Observation	CO1	0.869	0.541	0.944	0.939
	CO2	0.835			
	CO3	0.832			
	CO4	0.753			
Mother-Child Relationship	MR1	0.869	0.554	1.007	0.853
	MR2	0.861			
	MR3	0.840			
	MR4	0.838			
	MR5	0.834			
	MR6	0.814			
	MR7	0.797			
	MR8	0.772			
	MR9	0.680			
Father-Child Relationship	FR1	0.883	0.678	0.903	0.846
	FR2	0.876			
	FR3	0.865			
	FR4	0.858			
	FR5	0.841			
	FR6	0.830			
	FR7	0.822			
	FR8	0.726			
	FR9	0.651			

Table 2 presents the mean scores of adolescents with different genders and grade levels. Results from the independent-sample T-tests indicated that male students scored significantly lower than female students on the technical restriction dimension (t= -0.242, p< 0.05). No statistically significant gender differences were observed for other variables.

In terms of discriminant validity, the square root of each construct's AVE was greater than its correlations with any other construct (Table 3), confirming that the measurement model achieved satisfactory discriminant validity. Overall, these results confirm that the measurement instruments used in this study possess sound psychometric properties and are suitable for subsequent structural equation modeling analysis.

Table 3 Correlation Matrix Among Latent Constructs

	AA	TR	PP	MCR	GA	FCR	PM	AS	PR	RC	CO
Active Assistance	0.817										

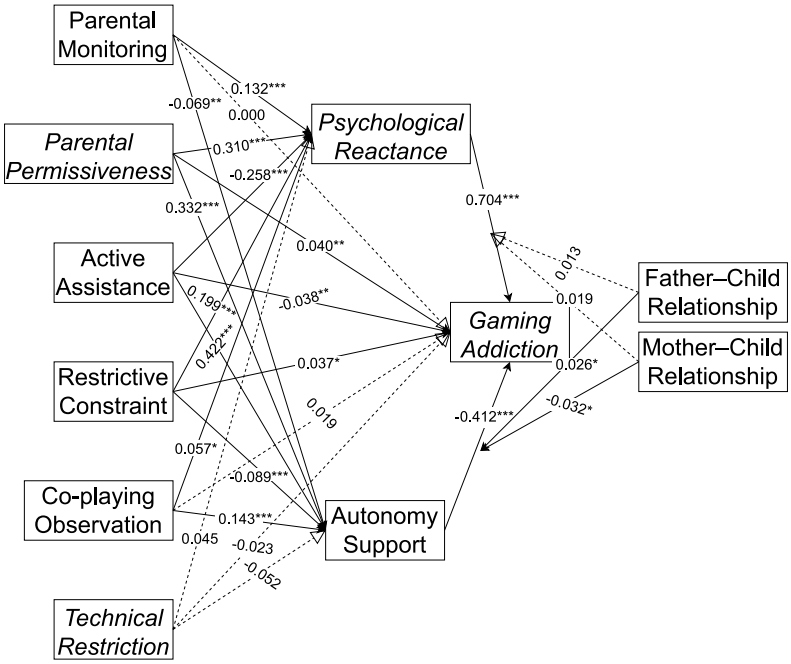
Continued

	AA	TR	PP	MCR	GA	FCR	PM	AS	PR	RC	CO
Technical Restriction	0.273	0.857									
Parental Permissiveness	0.208	0.064	0.804								
Mother-Child Relationship	0.447	0.089	0.149	0.805							
Gaming Addiction	-0.282	0.102	0.027	-0.285	0.769						
Father-Child Relationship	0.401	0.172	0.084	0.682	-0.225	0.812					
Parental Monitoring	0.184	0.633	0.030	0.039	0.152	0.111	0.896				
Autonomy Support	0.506	0.071	0.443	0.330	-0.354	0.250	0.008	0.749			
Psychological Reactance	-0.074	0.192	0.256	-0.18	0.690	-0.168	0.218	0.083	0.736		
Restrictive Constraint	0.283	0.435	-0.079	0.118	0.150	0.141	0.371	0.009	0.191	0.744	
Co-Playing Observation	0.469	0.481	0.153	0.295	-0.027	0.299	0.385	0.308	0.129	0.365	0.823

3.2.2 Structural Equation Modeling Results

(1) Path Coefficients and Significance Levels

The significance of the path relationships in the structural equation model was tested using the Bias-Corrected and Accelerated Bootstrap method and a two-tailed test. The computation converged after three iterations (Figure 1).



Note: *p<0.05, **p<0.01, ***p<0.001.

Figure 1 Path Analysis of the Structural Equation Model

The SEM analysis examined the relationships among the major variables. Table 4 presents the standardized path coefficients (β), t-values, and their corresponding significance levels.

Active assistance significantly and negatively predicted gaming addiction (β= -0.038, p< 0.05). Moreover, it showed a strong positive effect on autonomy support (β= 0.422, p< 0.001) and a significant negative effect on psychological reactance (β= -0.258, p< 0.001), suggesting that proactive parental involvement enhances adolescents' autonomy and reduces oppositional tendencies.

Parental permissiveness exhibited a significant positive effect on gaming addiction (β= 0.040, p< 0.05). It also positively predicted both autonomy support (β= 0.332, p< 0.001) and psychological reactance (β= 0.310, p< 0.001),

indicating that although permissive parenting may foster a sense of freedom, it can simultaneously trigger stronger resistance among adolescents.

Technical restriction did not significantly predict gaming addiction, autonomy support, or psychological reactance, suggesting that relying solely on technical measures to regulate gaming behavior yields limited effectiveness.

Restrictive constraint showed significant positive effects on gaming addiction (β= 0.037, p< 0.05) and psychological reactance (β= 0.199, p< 0.001), and a significant negative effect on autonomy support (β= -0.089, p< 0.00). These findings indicate that highly restrictive parenting may undermine adolescents; sense of autonomy, heighten psychological resistance, and consequently exacerbate gaming addiction risks.

Parental monitoring had no significant direct effect on gaming addiction. Still, it exhibited a significant negative effect on autonomy support (β= -0.069, p< 0.05) and a significant positive effect on psychological reactance (β= 0.132, p< 0.001). This suggests that excessive monitoring may erode adolescents' perceived autonomy and stimulate reactance.

Co-playing observation had a significant positive effect on autonomy support (β= 0.143, p< 0.001) and a marginally significant positive effect on psychological reactance (β= 0.057, p< 0.05), yet it did not significantly predict gaming addiction directly.

Among the primary psychological variables, autonomy support significantly and negatively predicted gaming addiction (β= -0.412, p< 0.05), while psychological reactance significantly and positively predicted gaming addiction (β= 0.704, p<0.001).

Table 4 Path Coefficients (β) and Significance Levels of the Structural Model

Path	β	t	p
Active Assistance → Gaming Addiction	-0.038	2.171	0.030
Active Assistance → Autonomy Support	0.422	17.978	0.000
Active Assistance → Psychological Reactance	-0.258	11.207	0.000
Technical Restriction → Gaming Addiction	-0.023	1.206	0.228
Technical Restriction → Autonomy Support	-0.052	1.854	0.064
Technical Restriction → Psychological Reactance	0.045	1.363	0.173
Parental Permissiveness → Gaming Addiction	0.040	2.574	0.010
Parental Permissiveness → Autonomy Support	0.332	15.899	0.000
Parental Permissiveness → Psychological Reactance	0.310	14.178	0.000
Mother–Child Relationship → Gaming Addiction	-0.036	1.927	0.054
Mother–Child Relationship × Autonomy Support → Gaming Addiction	-0.032	2.507	0.012
Mother–Child Relationship × Psychological Reactance → Gaming Addiction	0.019	1.191	0.234
Father–Child Relationship → Gaming Addiction	0.031	1.786	0.074
Father–Child Relationship × Autonomy Support → Gaming Addiction	0.026	2.061	0.039
Father–Child Relationship × Psychological Reactance → Gaming Addiction	0.013	0.756	0.450
Parental Monitoring → Gaming Addiction	0.000	0.009	0.993
Parental Monitoring → Autonomy Support	-0.069	2.677	0.007
Parental Monitoring → Psychological Reactance	0.132	4.840	0.000
Autonomy Support → Gaming Addiction	-0.412	27.404	0.000
Psychological Reactance → Gaming Addiction	0.704	49.487	0.000
Restrictive Constraint → Gaming Addiction	0.037	2.524	0.012
Restrictive Constraint → Autonomy Support	-0.089	3.635	0.000
Restrictive Constraint → Psychological Reactance	0.199	9.280	0.000
Co-Playing Observation → Gaming Addiction	0.019	1.148	0.251
Co-playing Observation → Autonomy Support	0.143	5.954	0.000
Co-Playing Observation → Psychological Reactance	0.057	1.984	0.047

(2) Explained Variance and Model Fit

The model demonstrated strong explanatory power for gaming addiction (Table 5), with an R^2 value of 0.651, indicating that 65.1% of the variance in gaming addiction was explained by the predictors included in the model.

Model fit was evaluated using the Standardized Root Mean Square Residual (SRMR) and the Normed Fit Index (NFI). An SRMR value below 0.08 and an NFI value approaching 1 indicate a good model fit. The obtained SRMR of 0.058 and NFI of 0.856 suggested that the model achieved an acceptable level of overall fit.

Table 5 Coefficient of Determination (R^2) for Endogenous Variables

Variable	R^2	Adjusted R^2
Gaming Addiction	0.651	0.649
Autonomy Support	0.478	0.476
Psychological Reactance	0.336	0.334

(3) Moderation and Mediation Effects

The moderating roles of the father-child and mother-child relationships in the path from autonomy support to gaming addiction were tested. Results revealed that the father-child relationship exerted a significant positive moderating effect, whereas the mother-child relationship had a significant negative moderating effect on this path.

Using PLS-SEM, the study further examined the direct, indirect, and total effects among variables. The bootstrapping method was applied to assess the significance of mediation effects.

Parental monitoring showed no direct effect on gaming addiction but exerted two fully mediated effects: an indirect path via psychological reactance (monitoring → reactance → addiction, IE = 0.093, $p < 0.01$); and an indirect path via autonomy support (monitoring → autonomy support → addiction, IE = 0.028, $p < 0.05$).

Restrictive constraint demonstrated a significant direct positive effect on gaming addiction ($p < 0.05$), along with two complementary mediation paths through psychological reactance (IE = 0.140, $p < 0.01$) and autonomy support (IE = 0.036, $p < 0.01$), both intensifying addictive tendencies.

Co-playing observation showed no significant total effect but exhibited a "dual activation pattern": a negative indirect effect through autonomy support and a positive indirect effect through psychological reactance.

Active assistance emerged as a protective factor — it directly inhibited gaming addiction ($p <0.05$) and exerted complementary indirect effects via both psychological reactance (IE = –0.182, $p < 0.01$) and autonomy support (IE = –0.174, $p < 0.05$), jointly reducing addiction tendencies through dual mediating mechanisms.

Technical restriction did not produce significant effects; the mediation via psychological reactance was nonsignificant, and the path through autonomy support was only marginally significant, indicating limited overall impact.

Parental permissiveness displayed a complex effect structure (Table 6). Both its direct and total effects on gaming addiction were significantly positive ($p < 0.05$). It also had a positive indirect effect through psychological reactance (IE = 0.218, $p < 0.05$), aggravating addiction, while simultaneously exerting a negative indirect effect through autonomy support (IE = –0.137, $p < 0.05$), producing a suppression effect — that is, the coexistence of direct facilitation and indirect inhibition in the same model.

Table 6 Mediation Effects in the Structural Model

Path	Significance of Indirect Effect (*p*)	Indirect Effect (IE)	Significance of Direct Effect (*p*)	Direct Effect (DE)	Significance of Total Effect (*p*)	Total Effect (TE)	Type of Mediation
Parental Monitoring → Psychological Reactance → Gaming Addiction	0.000	0.093	0.993	0.000	0.000	0.122	Full Mediation
Parental Monitoring → Autonomy Support → Gaming Addiction	0.008	0.028					Full Mediation
Restrictive Constraint → Psychological Reactance → Gaming Addiction	0.000	0.140	0.012	0.037	0.000	0.214	Complementary Mediation
Restrictive Constraint → Autonomy Support → Gaming Addiction	0.000	0.036					Complementary Mediation
Co-playing Observation → Psychological Reactance → Gaming Addiction	0.048	0.040	0.251	0.019	0.990	0.000	Full Mediation
Co-playing Observation → Autonomy Support → Gaming Addiction	0.000	-0.059					Competitive Mediation
Active Assistance → Psychological Reactance → Gaming Addiction	0.000	-0.182	0.030	-0.038	0.000	-0.393	Complementary Mediation
Active Assistance → Autonomy Support → Gaming Addiction	0.000	-0.174					Complementary Mediation
Technical Restriction → Psychological Reactance → Gaming Addiction	0.173	0.032	0.228	-0.023	0.383	0.030	No Mediation
Technical Restriction → Autonomy Support → Gaming Addiction	0.065	0.021					No Mediation
Parental Permissiveness → Psychological Reactance → Gaming Addiction	0.000	0.218	0.010	0.040	0.000	0.122	Complementary Mediation
Parental Permissiveness → Autonomy Support → Gaming Addiction	0.000	-0.137					Competitive Mediation

4 Conclusion

4.1 Mechanisms of Family Intervention in Adolescent Gaming Addiction

Drawing upon structural equation modeling, this study systematically examined the direct and indirect pathways through which different types of family intervention influence adolescents' gaming addiction. It further explored the mediating roles of autonomy support and psychological reactance, as well as the moderating effects of father-child and mother-child relationships. The findings provide both theoretical and empirical evidence for understanding how family dynamics shape adolescents' media behaviors.

In the direct pathways, active assistance significantly and negatively predicted adolescents' gaming addiction, indicating that positive and supportive parental strategies are effective in suppressing addictive tendencies. In contrast, both parental permissiveness and restrictive constraint exerted significant positive effects on gaming addiction, suggesting that excessive freedom or excessive restriction may exacerbate addiction risks. Technical restriction and parental monitoring showed no significant direct effects on gaming addiction, while co-playing observation significantly enhanced autonomy support but did not directly predict addiction, indicating a more complex set of indirect mechanisms. The results further demonstrated that autonomy support and psychological reactance served as significant mediators between most intervention types and gaming addiction, though the directions and magnitudes of their effects varied. Specifically, active assistance reduced gaming addiction indirectly by enhancing autonomy support and suppressing psychological reactance — both functioning as negative complementary mediations, reinforcing its overall protective

role. Restrictive constraint, by contrast, promoted gaming addiction through two positive complementary mediation paths: strengthening psychological reactance and reducing autonomy support, thereby jointly amplifying addiction risk. Parental monitoring had no significant direct effect on addiction. Still, it showed two fully mediated paths via reactance and autonomy support, suggesting that its negative impact operates primarily through psychological mechanisms rather than direct behavioral control. Parental permissiveness exhibited a suppression effect: it indirectly increased addiction through heightened reactance. Still, it simultaneously reduced it through diminished autonomy support, reflecting an internal conflict between permissive freedom and psychological disengagement. Co-playing observation revealed a dual-mediation offset pattern — an indirect negative path via autonomy support (reducing addiction) and a positive path via psychological reactance (increasing addiction). The opposing directions of these mediations neutralized each other, leading to a nonsignificant total effect. Finally, technical restrictions yielded no significant effects in any path, implying that purely behavioral or technological control mechanisms are insufficient to mitigate gaming addiction in the absence of emotional and motivational support.

The study further revealed opposing moderating effects of father-child and mother-child relationships in the path from autonomy support to gaming addiction. The father-child relationship exhibited a significant positive moderating effect, indicating that as the father-child bond strengthens, the protective effect of autonomy support against gaming addiction weakens or may even reverse. This finding suggests that while fathers may provide freedom and autonomy, they may also lack appropriate behavioral guidance, inadvertently increasing addiction risks. Conversely, the mother-child relationship demonstrated a significant negative moderating effect, meaning that stronger maternal bonds amplify the protective influence of autonomy support. This highlights the mothers' pivotal role in providing emotional warmth and behavioral guidance, thereby fostering adolescents' self-regulation and reducing their vulnerability to gaming addiction.

In summary, the study validates the heterogeneous mechanisms through which various family intervention styles influence adolescent gaming addiction. Among them, active assistance emerged as the most protective intervention, exerting its effects through dual mediation via autonomy support and psychological reactance. In contrast, restrictive constraint, monitoring, and permissiveness increased addiction risk primarily by undermining autonomy or triggering psychological resistance. These findings underscore the need for family-based education strategies that balance structure with autonomy, combining emotional support and rational guidance to effectively prevent problematic gaming behaviors.

4.2 A Multisystem Approach to Adolescent Gaming Intervention

Adolescence is a pivotal stage for self-identity formation. Parental intervention characterized by high control but low empathy often fosters distrust and psychological reactance, which may evolve into oppositional behaviors. Although motivated by protection, excessive monitoring or technological surveillance rarely reduces gaming time and may instead provoke avoidant immersion and compulsive play. Similarly, overly disciplinary parenting restricts behavioral freedom, whereas permissive parenting undermines emotional security and value guidance. Reactance arises not from restriction itself but from the absence of emotional support and understanding.

By contrast, autonomy support functions as a stable protective mechanism. Active assistance — the most effective family intervention — directly reduces gaming addiction and indirectly enhances self-regulation by promoting autonomy and reducing reactance. When parents guide rather than command — through joint planning, open discussion,

and genuine companionship — adolescents develop stronger self-control and a healthier relationship with gaming.

Based on these findings, several recommendations are proposed for families seeking to manage gaming behavior more effectively.

(1) Prioritize active assistance and cooperative family management. Parents should engage collaboratively with children to plan gaming time, assess risks, and balance online and offline experiences, thereby fostering both relationship quality and self-regulation.

(2) Avoid overreliance on monitoring or restriction-based control. Technical and behavioral constraints alone are ineffective and may heighten addiction risks through psychological reactance. Parents should shift from external control to internal motivation building.

(3) Focus on the quality rather than the quantity of companionship. Effective co-playing requires emotional resonance, boundary respect, and reciprocal communication. Surveillance disguised as companionship undermines its benefits.

(4) Promote parental role coordination. Given the divergent moderating effects of fathers and mothers, interventions should emphasize synergy: fathers should improve emotional communication, while mothers should continue to provide warmth and structured guidance.

(5) Establish family-based mental health mechanisms. Families should enhance psychological literacy, attend parental training, and recognize early signs of reactance or dependency to enable preventive rather than reactive intervention.

However, addressing adolescent gaming addiction cannot rely solely on the family. It is a multi-level social issue requiring the joint efforts of schools, communities, industries, and policymakers.

Schools should strengthen media literacy and psychological education by integrating healthy gaming awareness into curricula and providing counseling for at-risk students. School-family communication mechanisms should be institutionalized to ensure early detection and collaborative support.

Communities can extend family education by establishing youth psychological service centers, digital literacy workshops, and alternative engagement programs in sports, arts, and volunteering to enrich adolescents' offline experiences.

Game companies should assume corporate social responsibility by optimizing anti-addiction systems, reducing manipulative design incentives, and promoting a positive gaming culture that encourages balance and creativity.

Governments should establish long-term frameworks for youth digital well-being through public education, parental guidance programs, and multi-sectoral coordination among education, health, and technology agencies.

At a broader cultural level, society must redefine its perception of gaming — not merely as a source of risk or moral panic, but as a legitimate medium of entertainment, creativity, and socialization that requires guided engagement rather than stigmatization. Constructive recognition of games' educational and cultural potential can help transform public discourse from prohibition to guidance, fostering a more rational and balanced digital ecology.

In conclusion, this study highlights the pivotal role of family mechanisms in adolescent gaming addiction but also acknowledges its limitations — the analysis focuses primarily on family-level factors while excluding broader ecological dimensions such as school, community, and policy systems. Future research and practice should therefore adopt a multi-systemic, collaborative approach, integrating family, educational, industrial, and governmental efforts to build a sustainable, supportive environment for adolescents' healthy media development.

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