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The Impact of Violent Video Games on the Psychological and Behavioral Development of Generation Z

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Abstract: In the context of a digitally saturated society, Generation Z, those born after the 1990s, has grown up immersed in the internet and video game environments. Among these, violent video games (VVGs) have raised widespread concerns for their potential impacts on cognition, behavior, and mental health. Numerous studies have demonstrated that frequent exposure to violent content may increase adolescent aggression, suppress prefrontal cortex function, and elevate physiological stress levels. However, much of the existing literature centers on individual-level effects, with insufficient attention to the regulatory influence of broader social ecological systems and to cross-cultural differences in these mechanisms. This paper analyzes the multifaceted developmental influences of violent video games on Generation Z and to explore the buffering effects of social support in risk intervention. By reviewing relevant literature and synthesizing findings via the General Aggression Model (GAM) and social learning theory, it integrates evidence from neuroimaging, physiological stress responses, and behavioral patterns. The results show that violent video games greatly impair adolescents' impulse control, sleep quality, and emotional regulation. Nevertheless, family values, school media literacy, and community digital programs play a protective role against risks, especially in collectivist cultures. Thus, effective teen mental health support requires multi-level, socially systemic interventions.

Keywords: Violent Video Games, Generation Z, Mental Health, Social Ecological Systems, Risk Intervention

1. Introduction

In the era of rapid digitalization, Generation Z (born after the 1990s) is increasingly exposed to violent video games (VVGs), with 72% identifying as gamers and 60% regularly engaging with violent content [1]. It is found that exposure to VVGs increases aggression, reduces prefrontal cortex activity, and alters stress responses [2]. However, two critical gaps persist. Most studies emphasize individual effects, neglecting the support provided by family, education, and community. Besides, cross-cultural differences, especially in collectivist societies such as East Asia, are rarely examined. This study delves into the impact of VVGs on Generation Z's development and the influence of social moderators. In particular, it investigates the impact of VVG exposure on prefrontal function, stress hormones, and sleep quality, explores the protective effects of family values guidance, school media literacy programs, and community digital literacy initiatives, and considers how these

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relationships differ across cultural contexts. By reviewing relevant literature and integrating the General Aggression Model (GAM) with social learning theory, this paper brings together findings from neuroimaging, physiological stress responses, and behavioral patterns. By examining the neurobiological effects of violent video game exposure on Generation Z, it identifies key protective factors and offers policy- and practice-oriented recommendations to address the socio-cultural challenges of technology use through family and community engagement.

2. Media environment and the growth of Generation Z

2.1. Media exposure and the developmental trajectory of Generation Z

The socialization of Generation Z occurred during a period of unprecedented digital acceleration. And this technological shift fundamentally shaped the context in which their formative experiences unfolded. As such, their early development took place in a media environment characterized by constant internet connectivity, widespread mobile device use, and algorithmically curated content across digital platforms [3]. Such early and sustained digital engagement has influenced not only how Generation Z acquires information and communicates, but also how they perceive social reality, regulate emotions, and build interpersonal relationships. High levels of digital exposure have been associated with distinctive behavioral patterns, including reduced attention spans, heightened multitasking tendencies, and a marked preference for visual content. In addition, the development of Generation Z has taken place within a context of far-reaching socio-economic and cultural change. The early 21st century, defined by economic instability, labor market transformation, and growing mental health consciousness, has played a key role in shaping Generation Z's values, life priorities, and adaptive responses [4]. These broader socio-cultural shifts intersect with Generation Z's media engagement, potentially intensifying the dual potentials of digital environments for enrichment and harm, including exposure to VVGs and their related effects.

2.2. The prevalence and cultural penetration of violent video games

The widespread integration of VVGs into mainstream youth culture emphasizes the need to fully comprehend their prevalence and cultural impact on Generation Z. For this generation, gaming is not merely a form of leisure but has become an indispensable and influential part of daily life [1]. Notably, many popular games favored by this group are labeled by the ESRB as containing "Blood" and "Intense Violence." The violent content in VVGs manifests in diverse forms. Physical violence is mainly portrayed via combat scenes in which characters use firearms, swords, or hand-to-hand combat, prominently featured in action-packed titles like Call of Duty. In contrast, psychological violence encompasses non-physical harm such as intimidation, manipulation, or torture, commonly found in narrative-driven games such as Silent Hill. These elements are presented through realistic graphics, stylized animations, and vivid audiovisual effects that evoke horror or aggression, greatly enhancing player immersion and gameplay intensity.

Moreover, this widespread popularity of VVGs naturally leads to profound cultural penetration and influence. Cognitively, frequent exposure to violent content can condition aggressive cognitive schemas, enhancing their availability and increasing the probability of their activation in response to social cues. Emotionally, players may experience elevated arousal, fear, or anger during and following gameplay, which can interfere with typical emotional regulation processes. Behaviorally, existing research suggests that prolonged exposure to violent games can lead to desensitization toward real-world aggressive cues, potentially increasing the risk of impulsive and aggressive

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behaviors [2]. Furthermore, the sustained popularity of violent titles such as Grand Theft Auto has normalized virtual violence within youth culture. This cultural penetration not only alters players' perceptions and attitudes toward violence but may also blur the boundaries between acceptable and unacceptable violent behavior in real society. Thus, it is imperative to examine how VVGs, through cultural pathways, impact the behavioral development of Generation Z.

3. The impact of violent video games on Generation Z

3.1. The influence on the cognitive development

Increasingly, studies have focused on how VVGs affect adolescent cognitive processes, particularly through alterations in prefrontal cortex (PFC) functioning. And the PFC, essential for executive functioning and impulse regulation, plays a crucial role in aggression, with its functional alterations representing key neurobiological pathways underpinning aggressive behavior. Multiple randomized controlled trials utilizing functional magnetic resonance imaging (fMRI) have consistently shown that exposure to VVGs greatly reduces activation in the right dorsolateral prefrontal cortex (DLPFC) among adolescents, thus reflecting impaired inhibitory control. This diminished neural activity may reduce an individual's capacity to regulate impulses and aggressive tendencies, thereby increasing the likelihood of aggressive behavior [5,6].

These neurobiological findings align with the General Aggression Model (GAM), revealing how violent stimuli can facilitate short-term cognitive processing that enhances aggression. Specifically, violent content appears to modulate PFC-mediated impulse control, increasing the accessibility and activation of aggressive thoughts, which may reflect a transient neural "rewiring" effect. Moreover, social cognitive pathways play a crucial role in behavioral shaping. Through observational learning mechanisms, adolescents internalize aggression scripts from violent gameplay, which in turn shape their frameworks for conflict resolution in real-world scenarios, providing a theoretical basis for the long-term behavioral impact of violent games [7]. In addition, exposure to VVGs intensifies hostile attribution bias, making individuals more prone to perceive ambiguous social cues as threatening and more likely to respond aggressively. This bias reflects not only altered cognitive processing but potential disruption to social cognitive functions caused by violent game exposure [8].

3.2. The impact on the physiological stress and mental well-being

The physiological stress response system in adolescents is significantly activated by VVGs, leading to negative effects on their mental health and physiological functions. Two critical physiological indicators, salivary amylase (α-amylase) and cortisol, are commonly used to assess stress responses. It is found that when the stress system malfunctions, individuals are prone to negative reactions such as fear, and the rapid increase of salivary amylase reflects the immediate activation of this stress response. Besides, abnormal cortisol levels impair an individual's ability to cope with stress and affect the normal functioning of brain processes such as attention, decision-making, memory, and learning. The research on violent and stimulating video games have found that players exhibit significantly elevated levels of cortisol and α-amylase after gameplay, thus demonstrating a strong physiological stress response triggered by violent gaming [9]. The N-methyl-D-aspartate (NMDA) receptors in the central nervous system play a crucial role in excitatory signal transmission and neural plasticity. However, their excessive activation leads to the production of large amounts of neurotoxic substances that damage nerve cells and synapses. Such damage manifests as irritability, violent behavior, depression, and reduced cognitive readiness.

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Longitudinal studies have shown that adolescents who engage in violent gaming for more than two consecutive hours at night exhibit greatly elevated heart rates, with heart rate variability and other indicators reflecting heightened stress levels [9]. Moreover, these adolescents exhibit poorer sleep quality and higher psychological stress, further confirming the negative impact of VVGs on both physiological and mental health. Correspondingly, Table 1 presents heart rate and variability averages by game type and duration, illustrating the physiological stress differences associated with violent gameplay.

Table 1. Heart rate and variability (SE) during 2-hour violent and nonviolent gaming

	≤1h		≥3h		Group		Condition		Group× Condition	
	VG	NVG	VG	NVG	Fratio	p	Fratio	p	Fratio	p
HR	82.1 (2.9)	77.1(2.6)	76.5(2.2)	76.2(2.2)	0.92	.35	4.43	.044	3.45	.074
HF	1219.8(399.9)	1603.6(628.9)	1647.2(525.2)	1594.4(535.9)	1.01	.32	0.02	.88	1.70	.20
LF	1395.9(289.5)	1711.3(447.0)	1809.1(327.6)	1644.4(270.0)	1.17	.29	0.24	.63	2.91	.099
VLF	2825.6(634.1)	2406.7(501.4)	2600.0(481.3)	2177.3(243.1)	0.25	.62	1.68	.21	0.06	.80
LF/HF	2.4(0.5)	2.4(0.5)	1.9(0.27)	2.1(0.4)	0.53	.56	0.01	.93	0.23	.64

*SE=standard error; HR=heart rate; HF=high frequency; LF=low frequency; VLF=very low frequency; LF/HF=low frequency/high frequency.

3.3. The shaping of behavioral patterns

Extended exposure to VVGs markedly shapes adolescent behavioral patterns through the intricate interaction of cognitive, emotional, and social factors, leading to changes in aggression and conflict resolution strategies [10]. In particular, VVGs reinforce hostile attribution bias, causing adolescents to interpret ambiguous or neutral social cues as threatening, thus fostering a cognitive framework that normalizes violence as a means of problem-solving. This cognitive distortion not only increases the frequency of aggressive behaviors but also promotes the normalization of violent conduct. Also, impaired prefrontal cortex function diminishes self-regulatory capacities, particularly in delaying gratification and inhibiting impulsive actions, making adolescents more prone to impulsivity and risk-taking behaviors [11]. Besides, the physiological stress responses triggered by violent games, such as elevated cortisol and salivary α-amylase levels, exacerbate emotional regulation difficulties, increasing the likelihood of anxiety, depression, and other negative affective states, which further undermine psychological resilience and adaptive capacity. Moreover, family environment and peer influences play key roles in shaping behavior. These adverse effects are intensified by dysfunctional family dynamics or peer acceptance of violence, while active parental supervision and positive social support can effectively reduce the negative consequences of VVG exposure and promote healthier behavioral development. Through their influence on neurocognitive processes, emotional regulation, and social environments, VVGs greatly shape adolescent behavior, leading to heightened aggression, emotional difficulties, and compromised social and mental health.

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4. The role of social moderating factors

4.1. The moderating role of family education and parent-child support

Emotional support, value-based guidance, and behavioral regulation within the family collectively serve as protective factors that buffer adolescents against the negative effects of VVG exposure [12]. In family education, adolescents gradually develop their fundamental value systems and behavioral norms. Through everyday conversations and positive role modeling, parents can encourage children to reflect on violent content instead of simply absorbing it. Setting clear rules on game selection and playtime helps regulate behavior and prevent addiction. Moreover, a warm and supportive family environment can enhance adolescents' psychological resilience, helping them maintain emotional balance when exposed to violent scenarios in games.

Parental support further strengthens adolescents' ability to emotionally regulate their responses to violent content. By openly discussing gaming experiences and related emotions, adolescents are better able to separate virtual scenarios from real-life ones. Parental support through empathy and emotional direction is crucial when adolescents experience negative feelings as a result of gaming content. In addition, the provision of alternative, enriching activities, such as family sports, reading, or creative hobbies, diversifies adolescents' interests and curbs their reliance on violent games as a primary source of stimulation or emotional release. Family dynamics guide adolescent behavior, with parental conflict resolution modeling prosocial responses. By engaging in gaming with their children in a balanced way, parents can monitor behavior, provide guidance, and remain actively involved. Frequent family interactions and shared activities foster emotional closeness, strengthen bonds, and mitigate the isolating or desensitizing effects of VVGs. And a nurturing and emotionally secure family environment reduces adolescents' tendency to seek excitement or vent frustration through digital violence.

4.2. The influence of educational systems and socio-cultural contexts

The education system plays a critical role in shaping Generation Z's perceptions and responses to VVGs, not only through academic instruction but by cultivating values and social behaviors. By emphasizing critical thinking and media literacy, school curricula enable students to critically assess game content, recognize the line between virtual and real-world violence, and respond with sound judgment. Besides, mental health education focusing on emotional regulation, stress management, and conflict resolution boosts students' psychological resilience and lowers the risk of aggression or emotional instability induced by violent games [13].

The influence of violent video games on adolescents is further mediated by socio-cultural factors, particularly via the transmission of shared values and expected behaviors. In collectivist societies like many East Asian cultures, stronger family and societal norms help set behavioral boundaries that curb the impact of violent media. In contrast, adolescents in Western individualistic cultures, with more freedom in entertainment choices, may be more vulnerable to the subtle normalization of violence given reduced social regulation. Beyond the immediate contexts of family and school, societal norms and collective consciousness also shape adolescent gaming behavior. To restrict exposure to violent content, many societies implement external mechanisms such as rating systems in the West and government-imposed gaming limits in China. Public attitudes toward VVGs play an equally important role. If the prevailing social narrative treats such games as harmless entertainment, adolescents may underestimate their risks. Excessive stigmatization of video games can provoke adolescent defiance or curiosity, heightening their interest in violent content. In

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contrast, public education and media discourse that promote gaming as part of a balanced life encourage more mindful and self-regulated behavior. Together, educational and socio-cultural influences serve as a crucial buffer against the developmental risks of violent video game exposure.

4.3. The buffering effects of community support and digital literacy

The adverse impact of VVGs on adolescents can be significantly reduced through the presence of consistent and active community support [14]. As a key extension of socialization beyond family and school, communities provide adolescents with connection, belonging, and emotional support. By organizing activities such as sports and arts, community centers provide meaningful alternatives to screen time, thus fostering empathy and collaboration in adolescents and reducing the antisocial impact of violent games. Besides, guided peer and mentor interactions in safe community spaces can help adolescents process violent content, distinguish virtual from real violence, and strengthen emotional resilience and prosocial norms. In tandem with community involvement, digital literacy education plays a crucial role in shaping how adolescents engage with VVGs. It shifts adolescents from passive consumption to critical engagement with game structures, including violence-reward mechanisms and ethical distinctions between virtual and real contexts. Integrating digital literacy into education promotes critical evaluation of violent content, challenges harmful stereotypes, and raises awareness of media,s broader impact, thereby fostering informed, responsible gaming among adolescents. Moreover, it promotes essential skills, such as online safety, privacy awareness, and balanced screen use, that help reduce the psychological and behavioral risks associated with violent games. When integrated into school and community programs, it guides healthy digital habits by addressing gaming behavior, emotional regulation, and time management. In addition, skill-based workshops in areas such as game design, coding, and media production help adolescents transition from passive media consumption to active, reflective creation, thereby fostering ethical technology use and greater media awareness. These efforts are reinforced by collaborative initiatives involving parents, peers, schools, and communities, which establish shared norms, promote accountability, and support socially responsible engagement in digital spaces.

5. Conclusion

This study demonstrates that VVGs negatively impact Generation Z's cognitive, physiological, and behavioral development by impairing prefrontal cortex function, increasing stress responses, and reinforcing aggressive tendencies. Nevertheless, through media literacy, emotional support, and prosocial guidance, families, schools, and communities help reduce the harmful effects of violent video games. Addressing these challenges requires a collaborative approach, integrating parental involvement, school-based digital education, and policy measures to promote healthier gaming habits and safeguard adolescent well-being in an increasingly digital world.

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