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ORIGINAL RESEARCH

Internet Gaming Disorder Among Rural Left-Behind Children in China: A Sociological Qualitative Study

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Purpose: The rapid process of urbanization in China had led to a large number of laborers migrating from rural areas to cities, leaving their children behind in the rural areas. Internet gaming disorder (IGD) among left - behind children (LBC) had become a prominent social concern. Especially during the COVID-19 pandemic, LBC studied at home and had long-term exposure to electronic devices, which increased the risks and harms of IGD. The research aimed to analyze the formation, damage and factors of IGD among LBC sociologically, and explored its processes, harms and causes in China through data collection and in - depth analysis.

Patients and Methods: Between August 15, 2022, and March 25, 2023, with the consent of the participants, we conducted in - depth interviews with 21 sixth - grade students, 7 parents, and 7 teachers from 5 primary schools in Chinese rural areas. Employing the Grounded Theory method, we carried out three - level coding to analyze the interview data.

Results: The study found that left - behind children's IGD went through four processes: entering - immersing - exiting - re - entering video games. The causes involved the popularization of video game equipment, the deficiency of rural cultural infrastructure, incorrect guidance from parents and peers, as well as children's experiences in video games. Our analysis showed that IGD had a negative impact on children in four key aspects: cognition, physical and mental health, educational outcomes, and parent - child interaction.

Discussion: Left - behind children's IGD was a process from initial involvement to recurrence. The negative impacts of left - behind children's IGD interacted with each other. Multiple factors jointly led to left - behind children's IGD. Resolving children's IGD required the joint efforts of families, schools, communities, and the whole society.

Keywords: internet gaming disorder, IGD, left-behind children, LBC, processes, causes, harms

Introduction

Left-behind Children (LBC) refers to children who live in the location of their household registration, but do not live together with both of their parents, as either one parent or both parents have migrated outside of their hometown for more than six months. Rural children left behind specifically refers to those children left behind whose household registration locations are in rural areas.[1] In China, due to its rapid development and urbanization policies, a large number of rural laborers have flocked to cities in search of better job opportunities.[2] At the same time, millions of children have been left behind in rural areas, becoming Left-behind Children.[3] More than 60 million children have been left behind in rural China by parents going to work in cities.[4] The phenomenon of LBC is not just in China but also exists in other regions such as Eastern Europe, the Caribbean in Latin America, Africa, and Southeast Asia.[5] LBC has a higher probability of having behavioral problems.[6] The issue of LBC is of international relevance.

With the large - scale migration of rural laborers to cities, a substantial number of left - behind children have emerged. These children, lacking the direct supervision and company of their parents, are more likely to be exposed to the easily

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accessible video games in the digital age. The urban - rural digital divide, manifested in the disparity of digital infrastructure and access to online resources, also contributes to this situation, as the relatively lower availability of alternative recreational activities in rural areas makes video games an attractive option for these children.

Internet games have become a part of the daily lives of billions of people. According to the 50th Statistical Report on Internet Development in China released by the China Internet Network Information Center, as of August 31, 2022, there are over 1 billion Internet users in China, with those aged under 10 and 10–19 accounting for 4.2% and 13.5% respectively. The two groups, aged under 10 and 10–19, mainly consist of students receiving compulsory basic education. As of June 2022, rural internet users in China numbered 293 million, accounting for 27.9% of all internet users. However, the excessive use of Internet gaming may lead to a behavioral addiction known as Internet gaming disorder (IGD).[7] In recent years, the surging prevalence of online games has jeopardized the healthy development of the youth and inflicted potential damage on society. This situation has been a great headache for administrators across numerous countries and regions, especially during the COVID-19 pandemic when curbing the spread of online games effectively became an urgent task.[8]

Gaming disorder is defined in the 11th Revision of the International Classification of Diseases (ICD-11) as a pattern of gaming behavior characterized by impaired control over gaming, increasing priority given to gaming over other activities to the extent that gaming takes precedence over other interests and daily activities, and continuation or escalation of gaming despite the occurrence of negative consequences.[9] IGD is defined as a series of behaviors such as uncontrollable, excessive, and compulsive use of Internet games.[10] IGD is characterized by addictive behavior that can harm an individual's physical and social well-being.[11] Compared with other screen activities like social media platforms and short video viewing, internet gaming disorder has distinct impacts on children's emotional understanding ability, particularly for boys.[12]

IGD is prevalent in rural China.[13] Yang et al conduct addiction tests on 459 children from rural China. The study found that 151 participants (32.9%) were classified as addicted, while 308 participants (67.1%) were classified as non-addicted.[14] The report "Investigation and Countermeasures on Mobile Phone Addiction of Left-behind Children in Rural Areas" released by the Research Center for Chinese Rural Governance of Wuhan University in February 2023 shows that playing Internet games has become the main way for left-behind children in rural China. Among them, 5.66% of rural left-behind children have Internet gaming disorder. And 21.3% of parents think their children are seriously addicted to Internet games. The COVID-19 pandemic has seen a marked increase in the consumption of video game products.[15] Due to people's increasing reliance on online activities, this may further contribute to an increase in internet gaming disorder.[16] During the COVID-19 pandemic, game download volume has reached a record high, increased gaming during the pandemic may contribute to risk of gaming disorder.[17]

LBC is more prone to IGD than non-left-behind children.[18,19] Living in a rural area is associated with a higher risk of mobile gaming disorder.[20] LBC was found to be more susceptible to the adverse effects of IGD compared to urban children.[21] LBC spend considerably more time playing computer games than those in urban areas.[22] There are few entertainment facilities in rural areas, so LBC has limited entertainment activities.[23] Moreover, because children's parents are busy with farm work or working in places far away from home, LBC lack the company of their parents in their daily life.[2] The absence of parental supervision, LBC spend more time playing games than non-left-behind children.[18] Due to long-term separation from their parents, LBC has a significant sense of loneliness.[24] Parent-child separation leaves LBC unable to meet their basic psychological needs for extended periods, prompting them to seek solace in video games.[25] LBC show lower levels in aspects such as academic performance, mental health, and character building.[26]

Less attention has been given to left-behind children's IGD. The existing research on IGD mainly focuses on Chinese urban children.[27] The research on IGD among LBC is still limited.[28] It is of great significance to pay attention to this problem of left-behind children's IGD. The former study explored the issue from the perspective of children's mental health.[29] From a sociological perspective, this research analyzed the formation process, damage, and factors of IGD among LBC based on the experiences of children and their parents. The research aimed to answer questions related to the formation process, the harm, and the causes of IGD among LBC, and explained how being left - behind impacted on children's IGD. This was meant to attract more researchers to focus on the problem of IGD among LBC. Moreover, it emphasized the importance of social support rather than just psychological therapy for children with this disorder to reduce harm from Internet gaming disorder.

Research Methods and Procedures

Participants

This study was based on grounded theory. Grounded theory centers on participants' viewpoints. It emphasized psychological states and the construction of meaning. The results obtained through grounded theory analysis were highly consistent with the perceptions and experiences of research participants. Upper-grade primary students form a broad blended learning group consisting of individuals with diverse personalities, family backgrounds, and life experiences. To explore the underlying causes and impacts of children's IGD, relying solely on quantitative research would probably be unable to capture their inner thoughts and feelings fully. Thus, this study conducted in-depth interviews with them by setting various questions to reveal their thoughts and stories.

Purposive sampling was employed to select left-behind children suffering from Internet Gaming Disorder, as well as their parents and teachers for interviews. The LBC interviewed for this study were from Wenzhou, Jinhua, and Lishui in Zhejiang Province, China. Considering the economic development status of different areas, these cities were included. Wenzhou represents a high level of economic development, Jinhua is an intermediate level, and Lishui is a low level. With regard to the typicality of rural schools, five rural schools distributed in Jinhua, Lishui, and Wenzhou were selected. These include Luodian Town Central Primary School in Jinhua, Caozhai Town Central Primary School in Jinhua, Miaogao Primary School in Lishui, Suichang Meixi Primary School in Lishui, and Huwu Town Primary School in Wenzhou.

In this study, sixth - grade LBC with IGD were chosen as interviewees. The reasons were as follows: they were in a psychological transition from childhood to adolescence, with a spirit of defiance and rebelliousness, had more access to electronic devices and video games, and were often reluctant to listen to parents. Also, they could respond clearly to interviewers. The selection considered children's language expression and mental characteristics. The China Youth Research Center's Institute of Children's Studies noted in a public lecture that sixth - grade children were in a critical development period, curious about new things, with relatively weak self - control, and were easily addicted to online games. The selected sixth - grade LBC were 12–14 years old and lived in rural areas in China.

The IGD-20 Test was the first standardized psychometric tool for assessing Internet Gaming Disorder (IGD) in accordance with the nine IGD criteria proposed by the American Psychiatric Association in the latest edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5).[30] The Chinese Internet Gaming Disorder Test, which followed the IGD-20 Test, was conducted by Yu et al.[31] In this study, the child's teachers determined whether the child had an internet gaming disorder based on the child's performance in the previous 12 months and using the 20 questions in the Chinese Internet Gaming Disorder Test as the measurement criterion. If a child agreed or strongly agreed with all the options in the 20 questions, the child was judged to have an internet gaming disorder and became a potential interviewee in this study. Teachers provided researchers with personal information of children with internet gaming disorder. Based on the information provided by teachers, researchers consulted these children and their parents to see if they agreed to let the children be interviewed. After obtaining the consent of the children and their parents, interviews were conducted with the children.

Sample Information

Thirty-five (n=35) interviewees, including twenty-one left-behind children (n=21), seven parents (n=7), and seven teachers (n=7), were selected for this study. The number of interviewees was limited to 35 because no new categories or dimensions emerged in the theoretical structure of study after the interviews were conducted. Based on the principle of theoretical saturation, there was no need for additional interviewees. Among the 21 interviewed children, the male - to - female ratio was 5:2, with 15 boys and 6 girls. Their parents did not live with them and they were taken care of by their grandparents\grandmother\grandfather. To comprehend the reasons why LBC had IGD from multiple perspectives, teachers and family guardians were selected as interviewees. The selection principles for teachers and parents were that they were the parents or teachers of the interviewed children, and at the same time had the time and willingness to be interviewed. Seven family guardians and seven available teachers were selected. By conducting multiple rounds of interviews, maintaining a continuous connection with the interviewees over several months, and utilizing the data obtained from students, parents, and teachers for triangulation, the researchers ensured the reliability of the study. The average time LBC spent on video games daily was about 2 hours (see Table 1).

Table 1 Basic Information of the Interviewed Children

Student	Gender	City	Own e-d	Time e-g	Game type	Who t- c- t	Frequency -c-p	Large-e-f-a-r	Academic Record
JH01	Boy	Jinhua	Mobile phone	3 years	RPG	GRANDPARENTS	Once a week	None	The last 30%
JH02	Boy	Jinhua	Tablet	2 years	ACT	Grandparents	Once a month	Two	30%- 70%
JH03	Boy	Jinhua	Mobile phone	4 years	SLG	Grandparents	Twice a week	None	The top 30%
JH04	Boy	Jinhua	Mobile phone	4 years	ACT	Grandmother	Once a month	None	The last 30%
JH05	Boy	Jinhua	Tablet and mobile phone	3 years	ACT	Grandparents	Twice a week	None	The last 30%
JH06	Boy	Jinhua	COMPUTER	3 years	SLG	Grandparents	Once a week	Two	The last 30%
JH07	Girl	Jinhua	Mobile phone	4 years	ACT	Grandfather	Once a month	Three	30% −70%
JH08	Boy	Jinhua	Mobile phone	1 years	AVG	Grandparents	Once a week	None	The last 30%
JH09	Girl	Jinhua	Mobile phone	2 years	ACT	Grandparents	Once a month	None	The last 30%
JH10	Boy	Jinhua	Tablet	5 years	ACT	Grandparents	Once a month	Three	The last 30%
JH11	Girl	Jinhua	Mobile phone	3 years	SIM	Grandparents	Once a month	None	The last 30%
LS01	Girl	Lishui	Mobile phone	3 years	AVG	Grandmother	Twice a week	None	The last 30%
LS02	Boy	Lishui	Computer	4 years	AVG	Grandparents	Once a week	Three	The last 30%
LS03	Boy	Lishui	Mobile phone	1 years	ACT	Grandparents	Once a week	None	The last 30%
LS04	Girl	Lishui	Mobile phone	2 years	ACT	Grandparents	Once a week	None	30–70%
LS05	Boy	Lishui	Mobile phone	4 years	SIM	Grandmother	Once a month	None	The last 30%
LS06	Boy	Lishui	Mobile phone	4 years	ACT	Grandparents	Once a day	None	The last 30%
LS07	Boy	Lishui	Tablet	3 years	ACT	Grandfather	Once a month	Two	The last 30%
LS08	Girl	Lishui	Mobile phone	2 years	SIM	Grandparents	Once a day	None	The last 30%
WZ01	Boy	Wenzhou	Mobile phone	2 years	SIM	Grandfather	Twice a week	None	The last 30%
WZ02	Boy	Wenzhou	Computer	1 years	ACT	Grandparents	Once a day	Three	30% −70%

Abbreviations: Own e-d, Own electronic devices; Time e-g, Time of exposure to Internet games; RPG, Role-Playing Game; ACT, Action Game; SLG, Strategy Game; SIM, Simulation Game; AVG, Adventure Game; Who t- c- t, Who takes care of them; Frequency -c-p, Frequency of calling parents; Large-e-f-a-r, Large entertainment facilities around the residence.

Interview Outline

In this study, the interview outline was employed to interview children as well as parents to interview LBC, parents and teachers. The formal interview encompassed the following six dimensions (See Table 2).

This study employed the interview method for data collection, and the grounded theory approach was used for data analysis. All interviews with children, guardians, and teachers were conducted with informed consent. The interviews for this study were carried out between August 15, 2022, and March 25, 2023. On average, each interview with children lasted 45 minutes, while each interview with parents and teachers took an average of 55 minutes. Due to the COVID - 19 pandemic, the interviews were conducted online or offline. Two rounds of interviews were conducted to obtain detailed and accurate data. After sorting out the first - round data, the questions to be added were listed, and then the second round of interviews was conducted according to the interviewees' time.

Data Analysis

This study adopted a three - level coding process for stepwise theory construction. First, open coding was used in this paper to define concepts, attributes, and categories found in textual data and label the data. For example, in the level - 3

Table 2 Interview Outline

Interviewees	Dimensions	Questions
Children	Basic information about children's video gaming	1. How do you like playing video games? 2. Please share an interesting story when you play games 3. What gaming devices did you buy?
	Impact of playing video games	1. What's your relationship with friends since you started playing video games? 2. Do you think you cannot live without video games? 3. What changes have taken place in your study and life since you started playing video games? What do you think of these changes?
	Causes of IGD	1. Do your classmates and friends play video games? 2. Do your family play video games? 3. Why do you like playing video games?
	Interventions in IGD	1. How do your family treat you if you play video games? 2. How does your teacher treat you if you play video games? 3. How do you feel if your parents or teachers interfere with your playing video games?
Parents \Teachers	Attitude towards playing video games	1. How do you evaluate your kids who like playing video games? 2. Do you play video games in daily life?
	Interventions in children's playing video games	1. What measures have you taken to stop children from playing video games? What's the outcome? 2. What do you think of the causes that IGD ? How to change?

coding table for primary students, the response "It is extremely joyful to play games because I can outperform others" was attributed to psychological satisfaction.

According to the meaning expressed in interview texts, after conducting open coding line by line, axial coding was carried out to categorize the data divided in open coding. Through repeated thinking and analysis of the relationship between concepts, categories, and dimensions of higher abstract levels were integrated. For instance, "peer interaction, collective influence, peer choice, material satisfaction by parents, parental intervention" was attributed to others' influence. "Long playing time, personal hobbies, entertainment gain, game cognition" was attributed to personal factors. Subsequently, selective coding at level - 3 was initiated. Finally, five core categories were developed to outline the emerging main theoretical line roughly.

In this study, the coding was developed based on the interview data. The three - level coding tables for primary students, parents, and teachers were completed in accordance with the above coding principle. This study obtained interview transcripts by transcribing the interviews of those 35 interviewees. These transcripts were tentatively analyzed, decomposed, and labeled to capture local concepts and generate related categories, attributes, and dimensions. All the materials derived from the interview transcripts underwent three - level coding, and these dimensions were generated on the basis of the coding (see Table 3).

There was a close interrelationship among various selective codes. In fact, the harms and causes of children's internet gaming disorder interacted with each other and formed a closed loop. The harms of children's internet gaming became the cause for deepening internet gaming disorder. Accordingly, we constructed the framework diagram for analyzing the causes of rural children's IGD (see Figure 1).

Results

This study concentrated on left - behind children (LBC) suffering from Internet Gaming Disorder (IGD). It explored the formation process of IGD, the reasons why children developed IGD, and the adverse effects brought about by IGD.

Table 3 Three-Level Coding Table for Interviews

Open Coding	Axial Coding	Selective Coding
Reduced devotion to learning	Cognitive impact	Individuality
Occupational cognitive bias		
Violence desensitization	Psychological impact	
Deterioration of physical function	Physical impact	
Vulgar languages	Social interaction	Social communication
Time consumption in virtual interaction	Social relations	
Early contact with video games	Social context	Life at a specific time and space
Ownership of cell phones as personal property	Special phenomenon	
Companion relationship	Interaction with companions	Interconnected lives
Companion selection		
Comparing with companions		
Gregariousness		
Imitative behavior		
Neighborhood		
Materially satisfied by parents	Parentage	
Weak parental constraints		
Little parental companionship		
Weak school constraints on games	School involvement	
Weak teacher authority		
Entertainment	Gaming experience	Personal initiative
Satisfaction		
Excitement		
Perceived freedom		
Emotional relaxation		
Poor self-discipline	Autonomous rules	

The Formation Process of Left-Behind Children's Internet Gaming Disorder

Curiosity led left-behind children into video games. Children observe and imitate the behaviors of those around them.[32] When they see their friends, classmates, or family members playing Internet gaming, their curiosity about Internet gaming is aroused.[33] Driven by this curiosity, they are prompted to try and experience video games. Peer groups play a crucial role in the growth of adolescents.[34] Through imitating their peers, children step into the world of video games.

> I got in touch with games around the fourth grade. I saw my classmates playing video games and thought it was quite fun, so I wanted to give it a try. (Student-WZ20)

Left-behind children invested time, energy, and money into video games. After entering video games due to curiosity, in order to gain more gaming experiences, LBC will invest a large amount of time, energy, and money. Research has

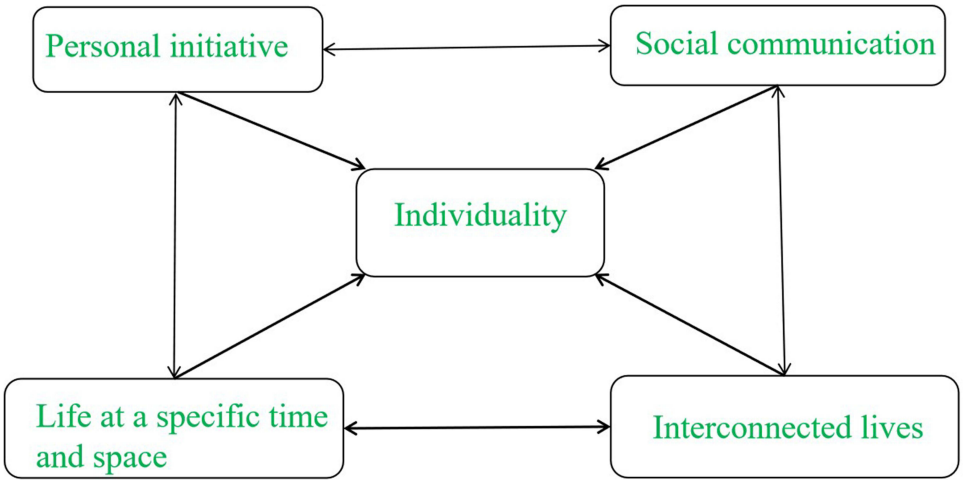

Figure 1 Generation model for left-behind children's IGD.

revealed that sixth-grade students regard playing video games as an essential part of their lives.[35] The sense of achievement from winning in games provides them with positive feedback, which encourages them to continue to invest more energy to obtain more victories.[36] The frustration from losing made them want to continue playing to change the result of failure.

> If I win, I'll continue playing to enjoy the fun of the game. If I lose, I want to keep playing because there will be a chance to win the game. (Student-LS05)

Spending money on video games was also a characteristic of their investment in games. LBC will use the New Year's money given by their parents to purchase the experience rights of video game. Spending money in video games can enhance the tactile and impact feelings of the game, enriching children's sense of experience.[37] Spending money could enable them to obtain more hidden skills in the game and increase the chance of winning. At the same time, spending money on games also allowed them to experience the joy of paying for their own interests.

Left-behind children quieted the game after getting tired of video games. After children had passed the immersion stage, the sense of achievement brought by video games gradually disappeared. They might encounter problems such as repetitive gameplay, network latency, or a bad physical experience caused by excessive playing time. Of course, losing the sense of novelty due to playing for too long may also be a reason for them to quit the game.[38] Investing too much time in the game leads to the loss of novelty and fun.[39] At this time, children would choose to temporarily exit the video game.

> After playing a lot, I don't want to play anymore. I'm tired of repeating the behavior of playing games every day. After spending too much time on online games, I will choose to uninstall the APP of video games on my mobile phone and refrain from playing video games temporarily. (Student-WZ18)

Left-behind children re-entering video games, sought the joy of life through video games. Despite having various bad experiences such as boredom and game lag, LBC made the decision to leave the game. However, this was not a real exit. They still re - immersed themselves in mobile games after their emotions had calmed down. In their life, regardless of whether the game was interesting or not, games always occupied a large part of their daily life.

> If there's nothing to do, I can only play games to kill the boring time. Or when I'm in a bad mood, I'll remember the happy experiences in the game and choose to enter the game again. (Student-LS05)

LBC went through the process of entering - immersing - exiting - re - entering video games. They never really quit but were always hovering on the edge of entering and exiting. On the one hand, they seemed to be tired of the video games they had played enough. On the other hand, they were still enthusiastic about joining video games.

The Reason Why Left - Behind Children Were Prone to Internet Gaming Disorder

The popularization of video game equipment caused left - behind children who were prone to Internet gaming disorder. The cohort in question referred to children from rural China who lived in an era when electronic devices were widespread. Our interviews were with sixth - grade students from rural primary schools in Zhejiang province (the post - 2005 generation). The wide availability of electronic products has enabled many of these children to access game equipment, either through their families' mobile phones or their own acquired devices.

> Many students have mobile phones. Since their parents work outside, they buy mobile phones so that their children can stay in contact with them. Grandparents, on the other hand, might not use them as frequently, but the children themselves do. (Teacher-JH03)

During the COVID - 19 pandemic, it became more convenient for children from rural China to access game equipment. To continue teaching tasks, local primary and secondary schools fully utilized online education platforms and online education resources to conduct the online teaching mode. Therefore, to ensure that students could participate in online teaching in an orderly manner according to the relevant government and school regulations, parents usually equipped their children with mobile phones, computers and other electronic devices.

> Little kids have poor self-control. During online classes, they gain access to their phones at the same time, which makes it easy for them to team up and play together. (Teacher-JH03)

The lack of rural cultural infrastructure caused left - behind children were prone to Internet gaming disorder. In rural areas, due to their distance from urban centers, they had underdeveloped economies, sparse populations, and lower commercial profitability. This led to a lack of large entertainment facilities. Constrained by such an environment, left - behind children turned to video games for entertainment.

> Many parents of the students in our class are working away from home. Grandparents and children seldom have common topics to discuss. Also, they rarely go out to play or have a place to visit. (Teacher-JH01)

Wrong guidance from parents and peers caused left - behind children who were prone to Internet gaming disorder. Some parents or elders, lacking the time and energy to address children's issues properly, gave mobile phones to children. This not only failed to solve problems but also created estrangement. Parents in a family who are unable to accompany their children or do not communicate with them frequently can result in children suffering from online game disorder.[40] In families where parents could not accompany or communicate frequently with children, the risk of children suffering from online game disorder increased.

> We work away from home. In order to keep track of our child's daily life, we choose to buy mobile phones or computers for our child. And at home, in order to reduce the child's crying, the grandparents also give the child a mobile phone to use. I don't think video games are helpful for their study. I become extremely angry when I see my kids playing games. In my opinion, playing video games is a waste of time that could be spent on studying. (Parent-WZ01)

Peers have a crucial influence on the behavior and development of teenagers.[41] LBC who observed their peers playing video games will imitate their peers to enter the game, which may eventually lead them to indulgence.

> Listening to classmates talking about video games is extremely lively. I think it seems very intriguing. I joined the game because then I can talk about it with my classmates. (Student -JH11)

Left-behind children's experience in video games caused left - behind children to be prone to Internet gaming disorder. All the interviewees agreed that playing video games was a good experience and could meet their needs. Video games possess characteristics such as virtual worlds, high simulation, audio-visual combination, fresh stimulation, and more.[42] These characteristics stimulate children's desire to play and cater to children's psychological needs for games. With their audio-visual combined aesthetic effect, video games stimulate the desire for games. The game's characters, music, and so on are beautifully designed to attract attention.[43] Video games often have level settings that take advantage of children's competitive nature, luring them to spend excessive time playing.[44,45] The rich content of video games meets the desire to take on different

roles in diverse scenarios, cultivating a sense of belonging to a team.[46] In addition, the immersive experiences and gradual attraction mechanisms utilized in video games are significant factors contributing to gaming disorder.[47]

> I think it is extremely cool to spend money on virtual gaming equipment. I can play a lot of roles in it. When I feel very angry, I go into the game to defeat opponents. If there's a particular character or player that I dislike, I might try to "kill" them. After defeating them, I can play more comfortably. (Student-LS08)

Video games can influence people's behavior.[48] Some interviewed children thought that being good at playing games was beneficial as it gave them a sense of belonging and helped them earn money and realize their value.

> There are many definitions of success, and achieving wealth freedom through playing video games is also a kind of success. This era can't just rely on learning or be just for nerds. (Student -WZ01)

The Adverse Effects of Left-Behind Children's Internet Gaming Disorder

Internet gaming disorder negatively impacted the cognition of left-behind children. The cognitive processes of LBC were particularly vulnerable during their developmental stage, and IGD disrupted these processes in multiple ways. In the realm of cognitive impact, games influence memory and attention. Even a brief exposure to violent video game can lead to more aggressive thoughts, hostile emotions, and an increased probability of aggressive behaviors.[49] A higher degree of IGD is negatively associated with poorer factual memory, problem-solving abilities, basic reading skills, written expression, clinical attention, problem-processing speed, and visual-spatial organization.[50] This is because the constant stimulation and fast - paced nature of video games can overtax the developing brains of children, making it difficult for them to focus on and process other types of information, such as that required for academic learning. The cognitive impact is also manifested in the loss of self-control.

> I can't control the amount of time I spend online. I might initially plan to play for just an hour, but often, before I know it, it's already midnight. I am aware that playing video games will affect my studies the next day, yet I just can't stop myself. (Student-LS08)

The interview data revealed that many primary students positioned their future career choices as game streamers or professional e-sports players. Since streamers could also earn money, LBC tended to regard being a streamer as their best career option. Meanwhile, primary students found school learning complex and tedious. Such cognitive deviation could easily mislead LBC to a wrong growth path and continue to reduce the time and energy they devoted to school. This misaligned career aspiration was not only a result of the glamorization of the gaming industry in the media but also a reflection of the limited exposure and guidance they received in their rural environments, further highlighting the complex interplay between IGD and their cognitive and environmental factors.

Internet gaming disorder was detrimental to left - behind children's health. Spending excessive time playing video games has an impact on physiology and psychology. IGD negatively impacts physical function in aspects such as physical health, anxiety, and sleeplessness.[51] Primary students are in the stage of physical development. Keeping their heads bowed for a long time can cause dislocation or distorted growth of their spines, shoulders, necks, and other body parts. The adverse consequences of IGD also include increased antisocial behavior, thoughts, and emotions, decreased prosocial behaviors, and lower empathy for others.[37] Most of the primary students interviewed have a strong sense of winning. Children get aggressive after playing video games.[52] This vanity is an implicit incentive that the game brings.

> Horrible Grandma (a simulation video game) has terrifying gaming sounds. When grandma's voice appears, I will feel extremely excited and sometimes even scream. (Student-JH04)

> When playing games, I desire to win and surpass others to be admired. Games have rankings; the higher the rank, the more admiration one can obtain. Sometimes, to improve my ranking, I would keep playing continuously to accumulate points. (Student-JH11)

The horror, fear, and excitement of the murders in games immerse primary students. Children may imitate violent behaviors seen in games and become accustomed to violence through prolonged exposure to games.[53] Expressing dissatisfaction through violence can lead to a tendency to resort to violent behavior to communicate with parents.

Most children who watch and imitate violence in the game carry implicit aggression, and some have shown explicit violent tendencies.

> In the game, one can only score by eliminating enemies. The more skilled you are the greater your influence. When my mother doesn't allow me to play games, I sometimes kick stools and throw things to express my dissatisfaction. (Student-JH01)

Internet gaming disorder had a negative impact on left-behind children's educational achievements. After analyzing the interview data, we discovered that the individual cognitive harms brought by IGD to children comprise academic achievement and self-cognition. Self-cognition level Self-cognition is primarily manifested in the deviation of career or interest cognition.

> Because playing games occupies my mind, there's no space left to learn school subjects. We often discuss games during school breaks; otherwise, I sit in my seat, not knowing what to do and feeling empty-minded. (Student-JH08)

> These children who play video games are listless in class, sleepy during the day, and excited at night. (Teacher-JH03)

Video games were highly engaging due to iterative updates of new features, thus attracting students to expend most of their time and energy on the game.[54] Players addicted to video games generally perform poorly in school.[55] In the interview, most children stated that they would unconsciously think about game scenes during class, and thus could not focus. Due to playing video games at night and having their minds preoccupied during the day, they also appear sleepy in class, cannot muster up energy, have issues with inattention, and other problems. After their academic performance declines, they encounter more learning difficulties, experience weariness, and lose interest in learning. Eventually, they turn back to video games for self-satisfaction. This forms a vicious circle where spending excessive time and energy on video games leads to a worse sense of learning.

> If I allow my child unrestricted access to video games all day, he will keep playing from morning until midnight. After a whole day of playing video games, he becomes extremely irritable and is unable to settle down to complete his school assignments. (Parent-JH03)

Rural parents had two kinds of educational mindsets that resulted in two extremes. One was an extremely high regard for children's learning. The main topic of communication with children was academic performance. This made children develop rebellious attitudes and devote themselves to games to find excitement and satisfaction. The other was a complete disregard for children's learning. Parents' familiarity with the internet and mainly negative attitudes toward video games have been positively correlated with children's IGD.[56,57]

> Every time they (children's parents) call me, they inquire about my studies. If I don't perform well at once, they scold me over the phone. I did well in the exam before and especially wanted to call them. However, if I'm not doing well, I dare not answer the phone. When my studies aren't going smoothly, I'm even more reluctant to answer their calls. I find them extremely bothersome. (Student-JH12)

The decline in academic performance among the children with IGD was evident in multiple ways. The children themselves reported difficulties in concentrating on schoolwork and spending excessive time on games instead of studying. This was corroborated by the teachers, who provided detailed accounts of the children's in - class behaviors and performance changes. The parents also expressed concerns about their children's decreasing interest in learning and falling grades. These consistent findings from the different data sources, which were systematically collected through our research design, highlight the comprehensive impact of IGD on the academic performance of left - behind children.

Internet gaming disorder undermined the interaction between family members and left - behind children. From the interviews, we learned that IGD caused LBC to spend a great deal of time in virtual interaction and significantly reduced the frequency of parent - child interaction. Interview data indicated that after children became addicted to video games, the parent - child relationship deteriorated. This was manifested in that children spent a large amount of time playing games and had less time interacting with their family members. Prolonged gaming led them to neglect communication with family members, thus making them miss out on opportunities to share life's moments, care for each other, and

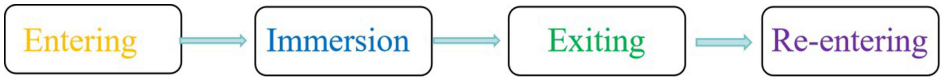

Figure 2 The four processes of left-behind children's IGD.

understand one another. The negative impact of IGD on children's social skills was reflected in the reduced time and frequency of communication with family members.

> We work in the city, far away from our child. We call our child occasionally after work. As soon as the kid comes home, he starts playing with the cell phone. When you ask him on the phone about his life in school, he either gives brief replies or no reply at all. If I ask too much about his study and daily life, he hangs up my phone and refuses to communicate. Then he becomes very impatient and retreats to his room, closing the door. However, before he suffered from IGD, he was willing to share his daily life with me during our phone calls and tell me the happy or sad things that happened to him at school or at home. (Parent-WZ04)

Discussion

Left - Behind Children's Internet Gaming Disorder Was a Process

The study analyzed the materials collected through interviews to explore how LBC entered the Internet gaming world and what characteristics were presented in each stage from entering video games to developing IGD. The four processes of left - behind children's IGD, namely entering - immersing - exiting - re - entering online games, were found in the study (See Figure 2).

LBC entered video games due to curiosity. Based on a survey of 1254 middle school children and focus groups with boys and their parents, researchers have found that children enter Internet gaming out of curiosity.[58] During the process of playing Internet gaming, they spend time and money. An empirical study from rural China shows that compared with non-left-behind children, LBC has a lower level of self-control.[59] Although some children in rural China know that it is incorrect to invest a lot of time and money in video games, they cannot control themselves from getting involved in the games. This conclusion can be explained from existing studies. Existing study has shown that the more time children spend on video games, the better their gaming experience will be.[60] However, some studies have also shown that gaming motivation has an impact on players' sense of well-being, while gaming time has no impact.[61,62] This can be explained by the fact that children's motivation for spending time on video games is to obtain a good experience. When LBC gets tired of Internet gaming, they choose to quit. This conclusion can also be verified from relevant study. The existing study has pointed out that players' detachment from Internet gaming is due to factors such as an increased negative perception of online games, awareness of their peers' negative attitudes towards them, awareness of other alternatives, and lower personal income.[63] After rural children stop playing video games, they still have to face the situation where there are scarce entertainment facilities and their parents are not around. As a result, they would once again be inclined to play games to relieve their sense of loneliness.

Multiple Factors Jointly Led to Left - Behind Children's Internet Gaming Disorder

This study found that the popularization of video game equipment, the deficiency of rural cultural infrastructure, incorrect guidance from parents and peers, as well as left-behind children's experiences were the reasons for left-behind children's IGD. These factors jointly led to left-behind children's Internet gaming disorder (see Figure 3).

With the widespread use of the internet, playing video games has become the most prominent form of entertainment for adolescents.[64] The COVID-19 in 2020 has seriously affected people's health, life and work.[65] The pandemic made it impossible for large-scale gatherings of people. Residents took the measure of home quarantine.[66] Children had to study at home for an extended period. While studying at home, children needed to use electronic devices to complete their schoolwork. And this exposure to electronic devices increased the likelihood of developing Internet Gaming Disorder.

Expanding Internet gaming and their appeal to players leads to increased gaming disorder. With their novel features like virtual worlds, high simulation, audio-visual combinations, and fresh stimulation, Internet gaming can stimulate left-behind

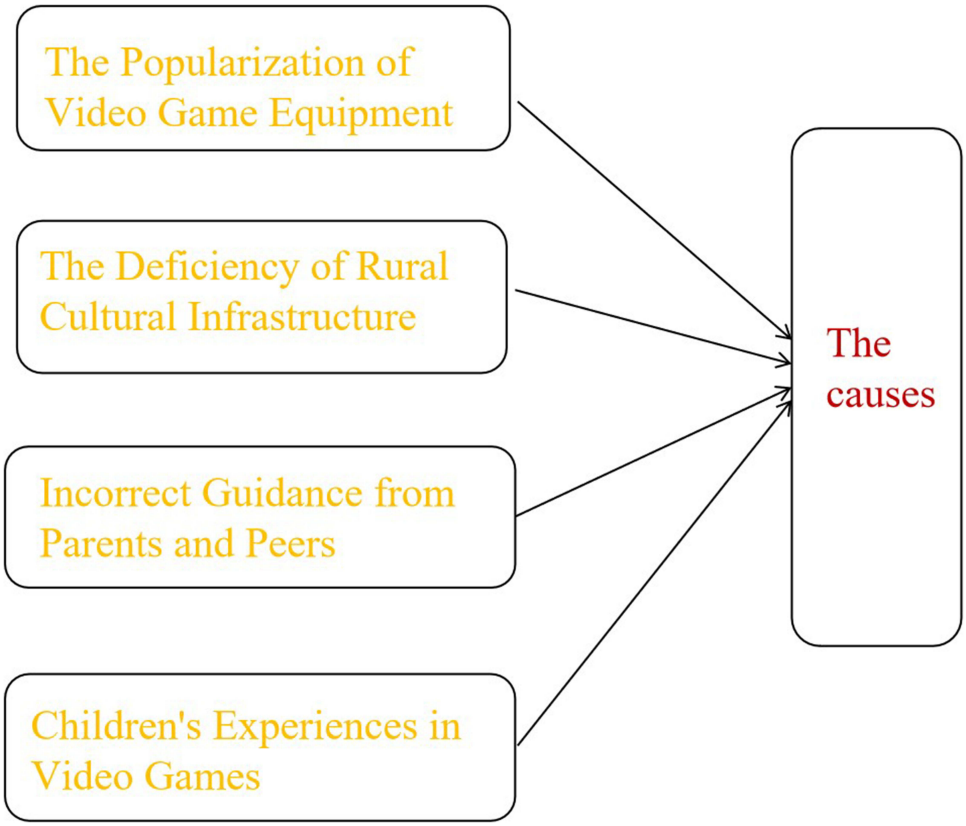

Figure 3 The causes of left-behind children's IGD.

children's desire to play. This is also consistent with the conclusion that the gaming experience is related to IGD.[67] The omnipresent electronic equipment has significantly increased the likelihood of left-behind children's exposure to video games. One study has indicated that the pandemic heightens the risk of children developing IGD.[68] Excessive internet use further heightens the risk of IGD.[69] External factors beyond the game can also contribute to IGD.[70] Previous studies find that living in rural areas can lead to a greater risk of IGD.[71] This result also verifies that in this study, children living in rural areas lack entertainment facilities, which increases the risk of IGD. Parents and other guardians have a remarkable impact on children's IGD. As previous studies have indicated, there is a link between the family and IGD.[72] The parents of LBC work in cities and cannot take care of their children beside them, which will affect the children's health.[73]

The Impacts of Left - Behind Children's Internet Gaming Disorder Were Interactive

The parents of LBC work in cities and cannot take care of their children beside them, which will affect the children's health.[74] Prolonged exposure to Internet gaming among rural Chinese children may lead to feelings of nothingness and morbid volition, such as low mood and reluctance to learn. The findings also confirm the conclusion of previous studies that gaming disorder affects children's academic performance and undermines their initiatives for social responsibility.[75–77] This outcome corroborates earlier research indicating that IGD has a negative impact on left-behind children's health. Addiction to violent video games can cause physical harm.[78] Increased video game usage is associated with worsened mental health outcomes[79] (see Figure 4).

Different from previous studies, this research found that the physiological and psychological harm caused by IGD could interact with each other. When playing games, left - behind children were prone to physical discomforts such as decreased eyesight, lethargy, and sore arms. And these harms could also have a negative impact on left - behind children's educational achievements. Due to IGD, children had poor academic performance, and poor academic performance would make them want to seek comfort in Internet gaming.

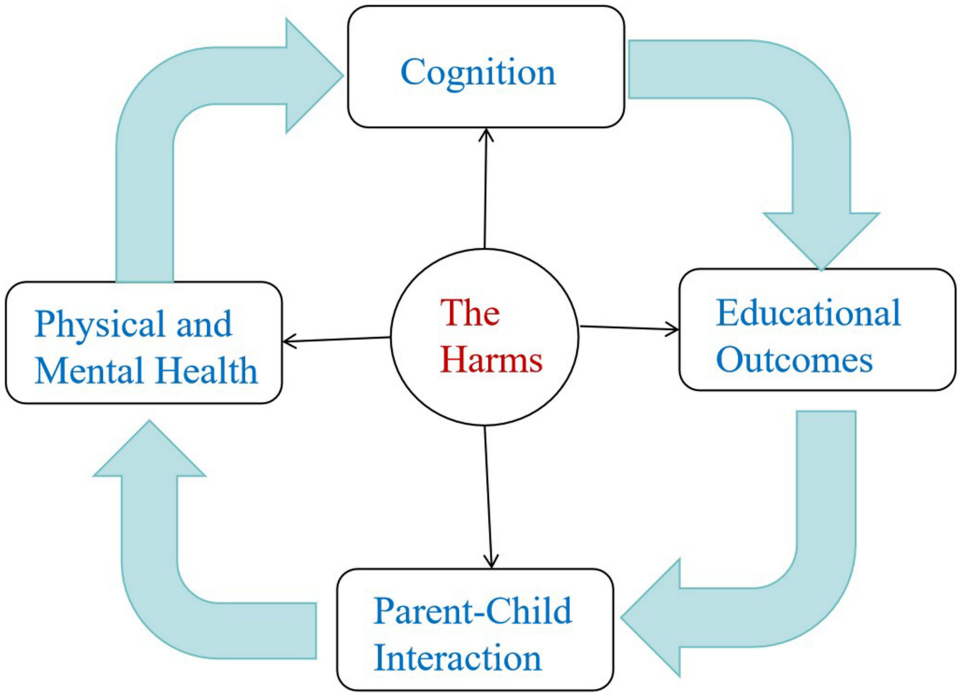

Figure 4 The impacts of left-behind children's IGD.

Recommendation

This study advocated for the joint efforts of families, schools, communities, and society in order to reduce the negative impacts of Internet Gaming Disorder (IGD) on rural Chinese children.

Parents need to adopt a balanced parenting style, concentrating on four main aspects. Firstly, they should act as positive role models both in deeds and words. Secondly, they should build strong emotional bonds with their children. Thirdly, they should offer meaningful company. And finally, they should use electronic devices responsibly.

Schools should play a vital part by taking the following steps. They should make full use of mental health counseling programs to educate students about the hazards of IGD. They should also enrich students' extracurricular activities to meet their various needs. Moreover, they should establish an addiction prevention learning system and a game supervision mechanism for video game education.

Rural communities can make contributions by creating a supportive cultural environment. They can provide diverse entertainment resources for children's development, organize lectures on the dangers of IGD, arrange children's fun competitions, and improve children's entertainment infrastructure.

Enhancing the supervision of children's video gaming activities is extremely important. This involves government bodies conducting strict evaluations of video game content and formats. It also requires updating video game-related laws and regulations to clarify the responsibilities of relevant parties. In addition, major gaming companies should actively cooperate with government authorities to implement measures to protect the well-being of minors.

Limitations

This study had three limitations. First of all, it was based on a small sample interview. When generalizing these results to children in urban areas, rural areas with sufficient technological resources, and areas with cultures different from that of rural China, caution should have been exercised. Second, although the grounded theory approach enabled a profound understanding of the impact and causes of Internet Gaming Disorder among rural children, it failed to provide a quantifiable measure of the extent of harm that children had endured. Future research could have dealt with this issue by developing a standardized harm scale through quantitative methods. Finally, this study did not compare the viewpoints of children, parents, and teachers. Such a comparison could have provided additional perspectives on the

complexities of IGD among rural children. In future research, large-scale data collection can be carried out to extend the research findings to different regions. Meanwhile, comparative data analysis can be added to make the research results more comprehensive.

Implication

The analytical model of this study on the causes of left - behind children's Internet Gaming Disorder enriched China's rural children's educational management theory and deepened the understanding of computer ethics. Practically, it was highly socially relevant. It proposed measures to reduce the harm of children's Internet Gaming Disorder, providing empirical understanding for dealing with the problem among families, schools, communities and society. It effectively guided social attention to the growth of rural children in the information technology era and stimulated thoughts on combining electronic devices with children's education.

Conclusion

This study was dedicated to exploring the processes, extensive harm, and causes of Internet Gaming Disorder (IGD) among left-behind children (LBC). Employing the grounded theory methodology, intensive interviews were conducted. After analyzing the data via coding, the findings were obtained. It was revealed that LBC's IGD follows four processes: entering, immersing, exiting, and re-entering video games. The study further concluded that IGD has a detrimental impact on LBC's physical, mental, and social growth. As a result, these children may withdraw from social and familial interactions or develop a more profound psychological dependence on the internet, with excessive gaming leading to a shortened attention span, increased internal aggression, declining academic performance, behavioral problems, social alienation, and physical ailments. Regarding the causes, the profit-driven nature of internet games renders them inherently attractive and addictive, compelling users to spend copious amounts of time and energy. Additionally, such games meet the psychological needs of LBC, while peer influence significantly contributes to fostering addictive behaviors. The environment in which LBC grows up also plays a vital role in determining their overall well-being.

Data Sharing Statement

The data related to this study are not stored in publicly available repositories and are private data. Data will be made available on request to the first author (Kaixin Bao: baokxin@zjnu.edu.cn).

Ethics Statement

The Ethical Committee of the Zhejiang Normal University reviewed and approved this study with the protocol code: ZSRT2022060. The authors obtained informed consent from all subjects including minors' parents who participated in this study, in compliance with the Declaration of Helsinki. All participants informed consent included the publication of anonymized responses and the use of the data for academic purpose.

Disclosure

The authors report no conflicts of interest in this work. This paper has been uploaded to [Research Square] as a preprint: https://www.researchsquare.com/article/rs-5101383/v1

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