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Pathological Gaming in Young Adolescents: A Longitudinal Study Focused on Academic Stress and Self-Control in South Korea

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Abstract

With the increase in social concern regarding pathological gaming among adolescents, the WHO (World Health Organization) included "gaming disorder" in the International Classification of Disorders, 11th version (ICD-11). However, little longitudinal research has been conducted examining social influences on pathological gaming, particularly in Asian countries (e.g., South Korea, China). With 4-year panel data from young adolescents (N = 968, 50.7% girls; M_{age} = 13.3 years) in South Korea, this study examined the effects of cultural environmental factors (parents' excessive interference, communication with parents, and friends' and teachers' support) on pathological gaming through academic stress and self-control. The results showed the critical role of academic stress and self-control in the effects of environmental factors on pathological gaming. Parents' excessive interference increased the degree to which youth experienced academic stress while the degree of communication with parents decreased this stress. Increased academic stress damaged self-control, which finally increased the degree of pathological gaming. Self-control affected the degree of pathological gaming stronger than gaming time did. The theoretical and practical implications from the study findings are discussed.

Keywords Pathological gaming · Gaming disorder · Excessive interference · Academic stress · Self-control

Introduction

Digital games have become a leading leisure activity among adolescents worldwide and such gaming may confer many benefits (Granic et al. 2014). However, overuse of games may also be associated with some negative outcomes. Pathological gaming refers to the excessive use of digital games to the extent that one's social relationships and daily functions are significantly impaired (Jeong and Kim 2011). Issues related to the prevalence diagnosis and, indeed, independent existence of disorders related to pathological gaming remain hotly debated among scholars (Aarseth et al. 2017; Griffiths et al. 2017). In some cases, such as in South Korea, concerns over pathological gaming have led to government efforts to restrict youth access to the internet during nighttime hours (Király et al. 2017), although the effectiveness of such strategies remains unclear (Lee et al. 2017).

Based on concerns regarding pathological gaming, several professional bodies have considered adopting diagnoses related to the phenomenon. For example, "Internet gaming disorder" (IGD) has been proposed as a classification for further study by the American Psychiatric Association (APA) in the Diagnostic and Statistical Manual for Mental Disorders, 5th version (DSM-5) (American Psychiatric Association 2013). Likewise, "gaming disorder" was included by the WHO in the ICD (ICD-11, 2018). As indicated by the provisionary status of IGD in the DSM-5, more research on pathological gaming is needed in the fields of prevalence and etiology because there is currently no agreement among scholars with regards to its symptoms and antecedents (Bean et al. 2017; Kardefelt-Winther 2015). In addition, pathological gaming has been reported to be particularly common in Asian countries like China and South Korea (Mak et al. 2014). In these countries, special cultural features such as high levels of academic stress and parents' stricter interference in their adolescent children's lives, may place youth in these cultures at higher risk for gaming disorder (Lee and Lason 2009; Seok et al. 2018).

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Previous research on the antecedents to pathological gaming focused on adolescents' environmental factors, such as their parents' attitudes, peer groups, and teacher support (Yen et al. 2007; Zhu et al. 2015). Related to such factors, some perspectives provide theoretical bases to its potential causality. The diathesis-stress framework, for example, suggests that some individuals may have a preexisting vulnerability to pathological behavior given biological and genetic factors. Such individuals may exhibit pathological behaviors under periods of high degree of stress (Davis 2001). Related, the deficient self-regulation model explains that lower self-control relates to problems regulating behaviors which may lead to symptoms of pathological behavior (LaRose 2010; Özdemir et al. 2014). Few studies, however, have investigated the effects of stress and self-control on the degree of pathological gaming in a path model. Moreover, little research has analyzed these in longitudinal settings involving adolescents.

To fill these gaps, this study proposed an integrated model of pathological gaming from the perspectives of the diathesis-stress framework and the deficient self-regulation model. Through the analysis of 4-year panel data collected from adolescent game users in South Korea, the role of academic stress and self-control between environmental factors and pathological gaming was examined.

Stress and Socio-Environmental Factors: Diathesis-Stress Framework

Stress, which refers to the degree by which an event or a psychological threat affects a person's mental health, is considered an important factor posing psychosocial risks and causing health problems for individuals (Windle 2013). According to the diathesis-stress framework, a representative psychological theory that attempts to explain the relationship between stress and sociopsychological disorders, psychological/mental disorders occur through an interaction between biological genetic risk and elevated levels of environmental strain. In particular, people with genetic or biological vulnerabilities that involve an increased risk of disease development respond more sensitively to stress than others do. Moreover, stress serves as a key factor causing physical and psychological problems for vulnerable people (Van der Aa et al. 2009; Windle 2013). Individuals exposed to stress cope with stressful situations or try to relieve their stress in various ways, such as by taking drugs and escape from reality, as the latter of which may include excessive and compulsive use of media (Caplan 2002, 2010; Maroney et al. 2018). In addition, as individuals who are exposed to a certain level of stress, especially those with vulnerabilities, perceive a given behavioral as a refuge from stress, they cannot easily escape from such habits and are thus constantly immersed in and dependent on them (Jacobs 1986).

Research reflecting the diathesis-stress framework has also been carried out in relation to pathological video game, internet, smartphone, and media use. Cho et al. (2017) reported that stress has a significant effect on adult overuse of smartphones. Velezmoro et al. (2010) also reported that many college students feel overwhelmed with stress and turn to and possibly overuse Internet to cope. In addition, it was reported in other research results that high levels of stress can have a significant influence on overuse behaviors, and that escapist coping strategies, such as avoidance, tend to aggravate such behaviors (Chwaszcz et al. 2018). In the same vein, reports on pathological gaming revealed that stress is a key reason for excessive game use by adolescents (Seok et al. 2018).

The impact of stress among adolescents may vary depending on whether one is in conflict with or receives support from one's parents, friends, and teachers. The article by Windle (2013) examines the dynamic diathesis-stress model for the adolescent children of alcoholics and demonstrates parenting deficits, limited socialization options, and isolation from peers serve as risk factors for negative outcomes in this population. Moreover, a recent study on pathological internet gaming reported that relationships with parents, teachers, and schoolmates have become major factors in triggering or preventing problematic behaviors among adolescents (Zhu et al. 2015). More specifically, teacher support can help reduce stress in the school environment, thereby inhibiting pathological gaming (Yu et al. 2015).

On the other hand, parent-adolescent conflicts and the deterioration of family functions, however, lead to the accumulation of stress stimuli and increase the severity of negative outcomes (Yen et al. 2007). Family intimacy or interpersonal relationships with peers and teachers also affect pathological gaming among adolescents (Lee and Bae 2015; Kim 2016). Particularly in relationships with parents, a high degree of parental control (excessive interference) increases stress or psychosocial problems, ultimately having a negative effect on the adolescent's game behaviors (Charoenwanit and Sumneangsanor 2014; Yen et al. 2007).

It is very likely that adolescents' academic stress is closely related to the degree of pathological gaming. Research conducted on elementary school students found that academic achievement and negative family relations significantly predict pathological gaming (Zorbaz et al. 2015). It should be noted, however, that as pointed out in the previous studies related to DSM-5, the Northeast Asian countries, including South Korea and China, show much fiercer competition in education than other countries do. Therefore, pathological gaming may be more serious among the adolescents in such countries due to their higher levels of academic stress. In this context, it can be predicted that the students in the given countries are more easily exposed

to problems due to academic stress, and that the degrees and impact of pathological gaming among them become even more significant

Self-Control and Pathological Gaming: Deficient Self-Regulation Model

Self-control (or self-regulation) refers to the ability to control one's actions for the attainment of a particular goal. It involves the capacity to pursue long-term goals by controlling one's undesirable behavior (Tangney et al. 2004; Vohs and Baumeister 2004). High levels of self-control are closely related to the ability to resist temptation and suppress impulsive behavior and sensory pursuits to achieve long-term goals (Hofmann et al. 2009).

Self-control ability has been examined as an important variable related to problematic media use and has been reported to have a significant impact on problematic internet and game behaviors (Kim et al. 2008; LaRose 2010). Tokunaga (2015) showed that problems with self-regulation are a significant cause of internet overuse and argued that the deterioration of self-regulation resulting from such psychosocial factors as depression, loneliness, and lack of social competence ultimately leads to pathological internet use. In the same vein, Kim et al. (2008) reported that online game overuse among adolescents is closely linked to the absence of self-control, based on the fact that high levels of self-control have a protective effect on pathological online game behaviors (Kim et al. 2008). On the other hand, low levels of self-control cause adolescents to seek immediate satisfaction rather than depend on long-term plans, leading to problematic behaviors such as game overuse due to a reduced ability to control their impulses (Cao et al. 2007; Özdemir et al. 2014).

It is notable in the deficient self-regulation model that personal self-control can exhibit a significant mediating effect between stress and pathological gaming. Self-control can also help suppress negative emotions and inadequate coping responses caused by extreme stress. When individuals suffer from symptoms of psychological distress, such as depression or anxiety, they may exhibit problematic behaviors like excessive obsession with certain media as a means to mitigate such emotions (LaRose et al. 2003). This means that self-control can be degraded when the individual is overwhelmed by a psychological threat, and it is also consistent with previous research findings showing that self-control may be temporarily impaired during the process of inputting resources to address external environmental and psychological problems (Ching and Tak 2017; Tice et al. 2001). Thus, self-control is influenced by psychosocial problems, including stress (Sinha 2009; Tokunaga 2017), and can in turn affect problematic behaviors, such as pathological gaming.

Current Study

The current study addressed four research questions. The first question was about the relationships between cultural environmental factors and academic stress. Specifically, the question considered what effects parenting attitudes (i.e., parents' excessive interference and communication with parents), as well as teachers' and friends' support have on academic stress among adolescents. The second question regarded the associations between academic stress and the other factors (i.e., self-control, daily gaming hours, and pathological gaming). The third research question regarded the effect of adolescents' self-control on the level of pathological gaming with control for daily gaming hours. The last question considered whether self-control has a mediating role between academic stress and pathological gaming.

Methods

Participants

A panel survey was conducted among 2000 young adolescents recruited from a professional survey agency in South Korea. This longitudinal survey was conducted four times within a span of 4 years (once per year, from T1 to T4). The participants received culture vouchers (valued at around US$50) as compensation for taking part in the survey. The accomplished survey forms that had missing values were excluded from the analysis, and the data obtained from the 968 study participants who had participated in all the four surveys were included. Of these, 477 (49.3%) were males and 491 (50.7%) were females, and 345 (35.6%) were elementary school students, 333 (34.4%) were middle school students, and 290 (29.9%) were high school students

Materials

Parents' excessive interference

To assess parents' overprotective behavior as perceived by the adolescent survey respondent, three questions were adopted (e.g., "My parents often stop me from doing what I want," "My parents are always interfering in my minor activities,"; National Youth Policy Institute 2013).

Communication with parents

Three items on the Open Family Communication Scale were used to check the quality of communication with parents (e.g., "It is easy for me to express all my true

Table 1 Descriptive statistics, reliability, and discriminant validity of constructs

Constructs	No. of items	Mean (SD)	Cronbach's alpha	CR	AVE
Friends' support	3	3.28 (0.58)	0.863	0.841	0.940
Teachers' support	3	3.51 (0.83)	0.874	0.730	0.890
Parents' excessive interference	3	2.26 (0.63)	0.700	0.537	0.776
Communication with parents	3	3.78 (0.80)	0.809	0.623	0.831
Academic stress	3	0.75 (0.49)	0.792	0.739	0.894
Self-control	3	3.17 (0.52)	0.790	0.570	0.798
Pathological gaming	20	43.72 (18.0)	0.966	0.532	0.940
Daily gaming hours	1	3.54 (1.7)			

SD Standard deviation, *CR* composite reliability, *AVE* average variance extracted

feelings to my parents," "My parents and I understand each other well"; Barnes and Olson 1982; Liu et al. 2015).

Friends' support and teachers' support

Social support refers to the subjective feeling of being accepted, of being loved, and of being needed all for oneself (Taylor 2011). For measuring friends' support, three items were used (e.g., "My friends comfort me when I am sad," Choi and Moon 2010). Likewise, three items of teachers' support were also measured (e.g., "I have a good relationship with my teacher," Kang and Shin 2015).

Academic stress

Academic stress is a major concern for students who are required to achieve good grades for college entrance. To measure the degree of academic stress, three items on the Life Stress and Coping Scale for Junior High School Students were used (e.g., "I tried hard, but my grades did not improve," Seo and Kim 2006).

Self-control

For the measurement of self-control, three items on The Brief Self-Control Scale were used (e.g., "I do certain things that are bad for me if they are fun,"; Tangney et al. 2004).

Pathological gaming

To measure the degree of pathological gaming, 20 items of the scale of Young's Internet Game Addiction was adopted (e.g., "I often do not sleep because I play games," "I often do find myself saying 'just a few more minutes' when gaming,"; Young 1998).

Daily gaming hours

For the daily gaming hours, the average time of daily gaming was asked, "How many hours do you play games a day?" with 9 options: 1 (None), 2 (<30 min), 3 (30 min–1 h), 4 (1–2 h), 5 (2–3 h), 6 (3–4 h, 7 (4–5 h), 8 (5–6 h), and 9 (over 6 h).

Reliability and Validity test

Reliability and validity tests were performed for the measurement values obtained. The reliability test results included Cronbach's alpha, composite reliability (CR), and average variance extracted (AVE) (see Table 1). The correlation and discriminant validity of the constructs were also checked (see Table 2). The result scores were all valid for the model test (0.8 for CR and 0.5 for AVE; Chin 1998). For missing data, a regression imputation method in the Amos program was used. This method is to replace missing data with substituted values by making linear regressions among variables (Graham 2009).

The current article reports how sample size was determined, all data exclusions, all manipulations, and all measures in the study (Simmons et al. 2012).

Results

Research Model Test

For the research questions, structural equation analysis was conducted using Amos 22.0. The results yielded valid and adequate indices for the model fit: IFI = 0.915, CFI = 0.914, and RMSEA = 0.065 (see Fig. 1).

The results showed that parents' excessive interference and communication with parents at T1 significantly affected the degree of academic stress at T2 ($\beta = 0.317$ and -0.156, respectively, $p < 0.001$, see Fig. 1). Teachers' support was also significant ($\beta = -0.187$, $p < 0.001$). Academic stress increased the adolescents' daily gaming hours at T3 ($\beta = 0.199$, $p < 0.001$). In contrast, academic stress decreased self-control at T3 ($\beta = -0.702$, $p < 0.001$). Self-control decreased the degree of pathological gaming at T4 ($\beta = -0.408$, $p < 0.001$) while daily gaming hours increased

Table 2 Correlations and discriminant validity analysis

Constructs	1	2	3	4	5	6	7
Friends' support	**0.940**						
Teachers' support	0.481	**0.890**					
Parents' excessive interference	−0.244	−0.133	**0.776**				
Communication with parents	0.422	0.466	0.405	**0.831**			
Academic stress	−0.195	−0.240	0.325	−0.311	**0.894**		
Self-control	0.163	0.151	−0.218	0.188	−0.376	**0.798**	
Pathological Gaming	−0.233	−0.194	0.186	−0.188	0.261	−0.387	**0.940**
Daily gaming hours	−0.176	−0.108	0.091	−0.181	0.110	−0.202	0.352

The square root of AVE (average variance extracted) is presented in boldface in the diagonal cells for the corresponding construct

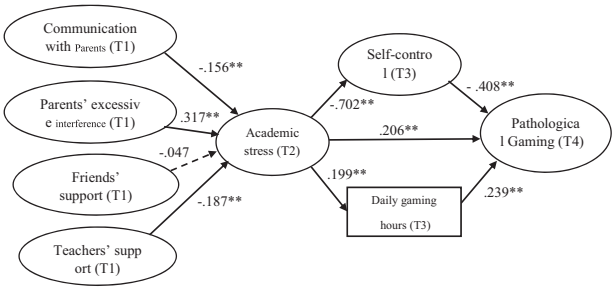

Fig. 1 Structural equation model. The coefficients are standardized, *$p < 0.01$, **$p < 0.001$

pathological gaming ($\beta = 0.239$, $p < 0.001$). Finally, academic stress at T2 was associated with increased pathological gaming ($\beta = 0.206$, $p < 0.001$)

Mediating Effect test

For testing the mediating effect of self-control, four conditions were tested: (1) whether academic stress significantly affected pathological gaming without including the mediator (i.e., self-control); (2) whether academic stress affected self-control; (3) whether self-control affected pathological gaming; (4) whether the relationship between academic stress and pathological gaming became insignificant or decreased when self-control was included. The direct effect of academic stress on pathological gaming without self-control was significant ($\beta = 0.237$, $p < 0.001$). Academic stress also significantly affected self-control ($\beta = -0.305$, $p < 0.001$), and self-control showed a significant effect on pathological gaming ($\beta = -0.344$, $p < 0.001$). The effect of academic stress decreased ($\beta = 0.145$ from 0.237, $p < 0.001$) when self-control was included ($\beta = -0.300$, $p < 0.001$). Thus, the result showed that self-control partially mediated the effect of academic stress on pathological gaming (James et al. 2006).

In order to confirm the mediating effect of self-control, Sobel's test was conducted. The bootstrapped 95% confidence interval was checked for the standardized indirect effect. The mediated effect of academic stress through self-control was significant (Sobel's $z = 7.513$, $p < 0.001$; 95% CI = [0.26, 0.40]). Thus, self-control was finally confirmed to mediate the effect of academic stress on the degree of pathological gaming.

Table 3 Model fit statistics and chi-square difference test

Model	χ^2/df	CFI	IFI	RMSEA	$\Delta\chi^2$(df)	p
Model-1	5.165	0.915	0.914	0.065	–	
Model-2 (delete: academic stress—pathological gaming)	5.197	0.911	0.912	0.066	21.91(1)	<0.001

Sensitivity Analysis

For the robustness of the findings, this study examined an alternative model (Model-2) where the direct path between academic stress and pathological gaming was excluded. The new model also showed valid indices for the model fit: IFI = 0.911, CFI = 0.912, and RMSEA = 0.066. However, the result of chi-square difference test showed that the first model (Model-1) is significantly better than the second model (Model-2) in the model fit (model-1 vs. model-2: $\Delta\chi^2(1) = 21.91$, $p < 0.001$, see Table 3). Thus, model-1 was the final model.

The sensitivity of the results was also examined using a simple OLS regression. In this regression all the T1, T2 and T3 variables were entered as predictors, with T4 pathological gaming as the outcome. There was no multicollinearity in this model, with the highest VIF at 1.801. This is obviously a crude analysis, and does not capture the complexity of the interaction between variables that was possible with the SEM. However, this method can help ensure that SEM did not inadvertently create spurious findings. As expected, T2 academic stress, T3 gaming hours and T3 self-control were all predictors of pathological gaming as was T1 friends' support. Although these analyses

do not adequately capture the theoretical model or complex interaction between variables at different time points, they do provide assurance that the ultimate findings of the SEM were not due to methods variance.

Discussion

Debate regarding whether pathological gaming is best conceived as a unique mental health disorder or as sequelae of other mental health issues such as stress continues in the academic community. This debate has intensified since the WHO declared it would include "gaming disorder" as a diagnosis in the forthcoming ICD-11. The current study was designed to examine the relationship between cultural environmental variables and the degree of adolescents' pathological gaming in a longitudinal setting. The roles of academic stress and self-control were investigated in an integrated model based on the stress-diathesis framework and the deficient self-regulation model. Results from this model suggest that conceiving of pathological gaming as a unique diagnosis rather than as a symptom of stress or other mental health concerns, may be mistaken.

The results of this study provide initial empirical evidence that support both deficient self-regulation model and stress-diathesis framework. According to the deficient self-regulation model, self-control as a cognitive factor plays a critical antecedent role to the problematic use of internet games (LaRose et al. 2003; Tokunaga 2017). By analyzing 4-year game-user panel data based on the previous results, this study showed that self-control has a stronger relationship with pathological gaming than gaming time. Likewise, this study demonstrated that academic stress is strongly related to self-control. This result is also in line with the diathesis-stress framework, which speaks to the role of stress in the development of mental disorders (Caplan 2002, 2010; Maroney et al. 2018).

Notably, the model results highlight the need to consider Asian countries' cultural peculiarities in studies of pathological gaming. As noted earlier, pathological gaming has been particularly reported within Asian countries such as China and South Korea where there are special cultural features such as high levels of academic stress and parents' excessive interference in their adolescents (Lee and Lason 2009; Seok et al. 2018). Related to the two variables, one of the common cultural factors between the two countries (i.e., South Korea and China) is the highly competitive college entrance exam. For entering best-level colleges, adolescents must receive high scores in the exam and parents generally interfere with their adolescents' daily life from the time of the adolescents' elementary school in order to put pressure on youth to study. Thus, it is natural to say that adolescents in these countries experience a higher degree of academic stress with excessive interference of their parents. The results of this study support the critical role of academic stress between cultural environmental variables and pathological gaming, and the role of parents in relation with academic stress.

Regarding the variables that influence academic stress, the results imply the critical role of parents in the mental health of young adolescents. There were contrasting results between parents' excessive interference and communication with parents. Parents' excessive interference significantly increased the degree of academic stress while communication with parents substantively decreased the academic stress. In addition, parents' excessive interference was much stronger in the effect on academic stress than those of friends' and teachers' support. Therefore, in order to decrease the degree of pathological gaming, parents need to control the degree of interference and increase the degree of communication with their adolescents.

Likewise, this study showed teachers' role in adolescents' mental health. Teachers' support of adolescent game users decreased the degree of the adolescents' academic stress. As adolescents spend most of their daily hours in school, teachers' support of and interest in their adolescent students may have a crucial role. Different from the expectation, however, friends' support did not show any significant effect on academic stress. Most Korean adolescents (over 70%) in their teens are playing games as a cultural routine (Kim 2016). As a social norm among adolescents, playing games with peers have become part of the general youth culture. Thus, such cultural routines of gaming with peers could desensitize the adolescents' perceived effect of peer support on stress. Future studies could investigate more about adolescents' gaming with peers on their mental health.

From the perspective of adolescent development, the results of this study are in line with those of previous studies in relation with mental health. With the salience of psychosocial challenges throughout the adolescence, environmental factors around family and school play important roles in the adolescents' stress and psychopathology (Tate et al. 2007). Over the course of adolescence, environmental factors influence the adolescents' stress and pathological behaviors (Dawes et al. 2000), and stress has a close relationship with psychopathology (Grant et al. 2004). This study helped demonstrate the effects of environmental factors such as parenting attitudes and teachers' support on the adolescents' academic stress and finally on the degree of pathological gaming. Considering adolescent development, those results suggest that much attention should be paid to environmental factors involved with coping with stress and how this influences pathological gaming among adolescents.

It is also notable that self-control mediates the effect of academic stress on the degree of pathological gaming. This result suggests the critical role that self-control may play in the development of pathological gaming. Adolescents with a high degree of academic stress may become susceptible to pathological gaming if they have a low degree of self-control. Those adolescents with higher degree of academic stress and lower degree of self-control could be especially vulnerable to pathological gaming.

Developmental Implications

Continued debate exists regarding the conceptual and developmental framing of pathological gaming. One school of thought argues that games are uniquely problematic due to their reward structures or even similarities to illicit substances (Saunders et al. 2017). Another school of thought has emerged to suggest that pathological gaming is better understood as one symptom of a larger constellation of issues related to stress, family structure and mental health (Aarseth et al. 2017). The current evidence more closely aligns with the second school of thought and suggests that direct comparisons between pathological gaming and substance abuse may be an incorrect association. Furthermore, these observations raise the question of whether the theorized reward structures of gaming are primary in the development of gaming disorder, or whether it may be better to conceptualize gaming as a coping mechanism for stress.

Thus, developmental pathways suggest that initial problems come from interactions with parents and teachers which can develop into academic stress. This stress, in turn both increases time spent gaming as well as difficulty in controlling gaming habits. Gaming, then, is a coping mechanism for stress, not the ultimate cause for the youth's difficulties, which appear to originate earlier in family and school systems. In this sense, conceptualizing gaming as a unique disorder may also be mistaken as it is likely that other activities that can be over done such as eating, sex, exercise, work, shopping, even dance (Maraz et al. 2015) could serve a similar coping function and, if overdone, perceived as pathological. Thus, conceptualization of a behavioral regulation disorder may make more sense than the World Health Organization's "gaming disorder" diagnosis (Aarseth et al. 2017).

Results from this study also provide some practical implications. First, the results provide policymakers and activists with useful directions for developing effective preventive policies regarding pathological gaming. South Korean adolescents, for example, are prohibited from playing games between midnight and 6 a.m. (Király et al. 2017). This policy is based on the premise that gaming time regulation is the most effective way of preventing pathological gaming. The results of this study show, however, that for preventing pathological gaming, it can be much more effective to concentrate on adolescents' self-control and academic stress. Decreasing adolescents' academic stress by providing healthy guidance for their parents' involvement in youths' academics or by increasing the degree of the teachers' support would likely be more successful in preventing pathological gaming among adolescents. Furthermore, this study results offer implications in the public health area, where internet games are often considered a primary causative factor for mental disorders. The degree to which Korea's policy on restricting access to gaming at night has failed to produce results can be understood in light of this study's findings (Lee et al. 2017).

Limitations

As with all studies, this study has some limitations. The data that were used in this study were collected from only one country. Future studies could collect data from similar countries like China and Japan and contrast the results of the effect size of the antecedents to pathological gaming with those obtained in Korea. Likewise, data from Western countries, particularly in highly technological environments, can be used to compare the different effects of social variables on pathological gaming cross-nationally. In addition, from the perspective of diathesis-stress model, future research could include genetic data to more fully test the model in comparison of cultural factors. Furthermore, from various data, more models based on different perspectives and theories can be compared.

Conclusion

Debates continue regarding whether pathological gaming can be attributed to features of technology or to social influences within youth family and school environments. Current results suggest that pathological gaming is a symptom of underlying stress and mental health issues, rather than an "addictive" diagnosis in and of itself. Increasingly, the concept of problematic gaming as a unique disorder has been challenged. Rather, evidence from the current study as well as considerable past research finds that problematic gaming tends to originate as a symptom of other syndromes related to stress, depression and anxiety. The concept of problematic gaming is probably best understood as a symptom of larger problems in the family and school spheres of life, rather than one brought on due simply to exposure to video games.

Authors' Contributions EJJ conceived of the study, conducted data collection and statistical analyses, wrote the draft of the manuscript;

CJF helped write the final draft and helped with additional analyses; SJL assisted in conceiving of the study and assisted in the statistical analyses and writing. All authors read and approved the final manuscript.

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Data Sharing Declaration Data of Korean Game Panel Study (KGPS) were used. The data that support the findings of this study are available from Korea Creative Content Agency (KOCCA, http://www.kocca.kr/gameguide/contents.do?menuNo=203705) but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. However, data are available from the first author upon reasonable request and with permission of KOCCA.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

Ethical Approval The study received the ethical approval of the Institutional Review Board (IRB) in Konkuk University, 7001355-201408-HR-031.

Informed Consent Youth and their parents were provided with informed consent about the survey and its basic nature as part of the panel recruitment.

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